## SOME REMARKS ON A UNIFORM SYSTEM OF DRAWING DEEDS AND PLANS OF LAND FOR RECORD.

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Every civil engineer and surveyer who has had occasion to consult the registry of deeds in the county or city where he is practising, cannot fail to have noticed the nondescript character of the plans or maps that are on record and the faulty character of many of the deeds.

In these museums of the draughtsman's art we find plans made on all varieties of material, from vellum cloth to brown paper and legal cap, and in all stages of dilapidation.

The heterogeneous collection exhibits all conceivable styles of chirography and typography. In some a whirlwind appears to have swept over the paper from different directions prostrating all the trees in its track. A few, and they are *very* few, show the work of a skilled draughtsman. The great majority show a sublime ignorance of the teaching of old father Gillespie, especially in the matter of lettering.

Very many of the plans have the title and all other information written in a scrawling legal hand, and many of those that have pretensions to lettering are so wretchedly executed that we cannot help wishing that the artist had had less ambition and been content with the script of his fathers.

Often we find the maps drawn on the back of deeds without any attempt at a scale. Maps and plats of more pretensions are often drawn incorrectly, the scale omitted, figures omitted for dimensions of lots or width of streets, the magnetic variation is omitted, and the date, and it is not strange that the surveyor has often omitted to place his name on the record.

All of these things are sometimes missing on the same map, while hardly a single recorded plat is complete with all.

Now the result of all this carelessness is frequently the defeat of the very object the record plats were intended to fulfill.

A plat or map deficient in all or some of these requisites is generally worthless to the surveyor, when he tries to utilize it. They furnish an excuse and ready opportunity also to the lawyer for contesting the location of the boundaries, the extent of the property, and even the validity of the title, for a faulty plan or one deficient in the prime requisites, is always worse than none, as it is ever a source of unfailing danger, as affording loop holes for the legal acumen of opposing counsel.

A sharp lawyer, aided by an expert engineer can twist almost anything they want out of one of these maps.

A case in point occurred in Chicago. A certain suburban tract was laid out many years ago into streets and lots by speculators and put upon the market. The recorded plan showed rows of parallelogram shaped lots, between streets running apparently at right angles. It was coarsely and hurriedly drawn and the widths and lengths of the lots were put down only on one row of lots across one end, and along one side of the plan, and not on all the sides of the lots. The lots all appeared of a uniform size on the plan, but years after, when the lots which had been sold by number and reference to the plan, and an area of "more or less," were settled up and built upon and had become, valuable, recent surveys showed the opposite sides of the tract to be very unequal, and the decision of the court was, that as there was no positive evidence that the lots were all the same size, those lots whose dimensions were not given, must be made to assume the dimensions that would result by distributing the shortage *pro rata*, and a very material and important difference it proved to be, and fall through the carelessness or laziness of the draughtsman in not putting the full dimensions on each lot.

What can be more uncertain than many of the surveys made to establish old boundaries from old recorded plats or deeds in a rapidly growing region when all old landmarks are obliterated?

The surveyor is furnished with a deed, which while abounding in legal redundances and repetitions is singularly deficient in the most vital part, *i. e.*, a common-sense description of the land. The description generally consists of "Northerly 20 rods, easterly," etc., etc. The variation of the needle used or that existing at the time is never given. The fact is almost never stated whether the courses, when given, are from the polar meridian or the magnetic. The surveyor must find this out by intuition. The date of the survey can only be judged by the date of the deed, and the name of the surveyor or the instruments used are never mentioned and it is very seldom that any reference is made from the corner begun at, or any other, to the nearest street corner.

The writing of these deeds is generally confided to some justice of the peace in the country, who when not thus engaged is perhaps pegging shoes; or, in a city, the law student in an attorney's office, who considers himself far too much of a genius to waste his valuable time on such trivial matters. He takes the plan furnished by the surveyor and hurriedly takes off a description of the land, or more commonly he has recourse to an older deed of the property and copies its description with all its imperfections and errors, his imagination in the meanwhile teeming with forensic eloquence and his mind wandering in imagination to the time when he hopes, with his Websterian power and ability, he will address the court and the dazzled jury.

Deeds have been handed to the writer that without referring to any recorded plan or map, failed to give a single distance. Others making more pretensions to accuracy gave distances and courses, but by a mistake of the person who drew up the deed a whole side of the lot had been omitted.

I have often come across deeds drawn by careful conveyancers or by the surveyors themselves, with every pretension to care and accuracy, describing land in a city or town and starting from a street corner have failed to state whether the corner of the street as it actually existed was meant or the corner as defined by the legal and adapted street lines, often involving a material difference. This is a very common error.

Again, your deed will often take you to a ditch or a brook or a country road, and fail to say whether the centre or the right or left side is intended.

The writer has seen plans drawn by a man who had been chief engineer of a railroad 200 miles long on which the streets were marked as 50 feet wide, but they actually measured by the scale 200 feet.

Another very common error, and one that ranks the civil engineer guilty of it, at once as a man unqualified to dignify himself by that name, or even

that of a surveyor, is the length of diagonal lines in exterior lots.

For instance, we have a couple of streets of unequal length and parallel to each other, ending in a boundary line, such as a railroad, as in the sketch. The lot *A B C D* has the sides *A C* and *BD* parallel and at right angles to *AB*. Then must *CD*= $\sqrt{200^2+25^2}$. But we too frequently find this mathematical truth ignored and the distance *C D* set down at variance with the time honored "*pons asinorum*."

When it comes to plats of land and deeds bounded describing land bounded in part by true curves, the matter, as Mark Tapley would say, becomes "awfully jolly" to dwell upon.

Now there are those persons who are generally responsible for these things, *i. e.*, the surveyors, the lawyers and the recorders or registrars.

Now as a surveyor I am bound to stand up for my professional brethren, and I say boldly that the surveyors are not so much to blame as might at first appear.

Some of them are "poor sticks," it is true, but it often happens that the best and most painstaking of them will be utterly thwarted by the penuriousness of his client.

Cases have occurred in my practice where a plan of certain properties made with great care and elaborateness and handed over to my client has been kept by that person and a cheaper copy made and put on record. Often this copy is made by the register himself, without regard to scale, on a half sheet of legal cap, and a nice time he has of it. He generally goes to work, bookkeeper fashion, with a common pen and a ruler, and if Ruskin is right that coarse lines and striking effect constitute artistic characteristics his copy can be classed as a *chef d'œuvre*.

Some registry offices keep a number of copyists, and what the scribe St. Benjamin would call "Asokald Draftsman," but generally they have the same artistic proclivities recommended by Ruskin. The result is that a copy is recorded with the surveyor's name on it and which he never saw and would be sorry to own.

Now it seems to me that this state of things demands a remedy. We cannot very well compel surveyors to make their plans all of a uniform size and style like patent office drawings, nor can we give a sample copy of a deed to a lawyer and compel him to use it, if the matter stops there, but the proper authority can prescribe what shall and what shall not be received by the register. This is now done in the case of railroad location plans in some States. In the North there are county and city registers of deeds. In the South the office is generally filled by the county clerk or clerk of the circuit court. They are generally political aspirants who bring to the office no qualifications or experience. As it would be impossible to have experts for all these offices it would seem desirable that this official be allowed to receive only such deeds and plans for record as fulfil the following conditions:

### DEEDS.

All deeds presented for record, except in special cases as hereinafter noted, must state in the description,

The length of all lines.

The courses, and whether true or magnetic, or the enclosing angles.

The variation of the needle when the survey was made.

The date of the survey.

The area or areas.

The name of the surveyor.

The kind of instruments used, and whether chain or steel tape.

A full and clear description of the monuments.

When a street, road, or passageway is a boundary, the description must refer only to the established and legal line at that time.

When a ditch, canal, brook or river is a boundary the deed must state distinctly if one side or the centre is intended.

When the boundary is the ocean or arm of the sea, the deed must state distinctly whether the distances refer to extreme or mean high water or low water, or the adopted harbor line and if the riparian rights are included.

When the boundary is a fence or wall or hedge, it must be so stated.

When the boundary is an arc of a circle the radius must be stated.

Exceptions to these rules will be such deeds only

as refer to recorded plans by lots and numbers, or to previously recorded deeds of the same property.

MAPS AND PLANS.

All maps and plans or plats presented for record must have distinctly stated thereon:

The true distances or lengths of the boundary lines and plainly indicated to the exact points.

The courses, and if true or magnetic, or the angles between the boundary lines,

The area or areas.

The date of survey.

The variation of the needle at the time and direction of the meridian.

The scale.

The monuments, stakes and reference points, and the kind and size.

The radi of all true curves.

The extreme and mean high and low water lines.

The existing and the established or adopted legal street or road lines.

The width of all streets and the dimensions of all lots and the areas.

The fences, walls, hedges, ditches, or other artificial or natural boundaries.

The title and the name of the surveyor.

All titles, legends, notes, remarks, names, etc., must be neatly printed by hand or otherwise, and the maps or plans finished in an artistic manner.

In cases of disputed boundaries reference must be made on the plan to the law or court ruling under which the line has been established.

All maps, plats or plans presented for record shall be drawn on vellum cloth, and if drawn on any other material shall be rejected.

The title shall state the name of the tract or the owner, and the town, county and State.

The legend shall contain full explanatory notes of all obscure or otherwise indefinite points.

The conventional signs for topography, adopted by the U. S. Coast Survey shall be used.

Buildings, near the boundary lines, shall be shown.

The following conventional colors will be allowed on maps or plans and plots of record:

Prussian blue for water.

Light green for grass land,

Bright green for trees.

Burnt sienna for buildings and bridges.

Sepia for roads and streets.

Natural tint for stone buildings.

Red for brick.

India ink for iron work.

Different areas may be distinguished by different and appropriate tints of which full explanatory notes shall be made on the map.

The objects desired to be accomplished in deeds and plats of record are accuracy, legality, clearness and legibility, which it is believed can be secured by following the plan just outlined.

It would seem to be legal and proper for the different States to make the matter the subject of statutory enactments, which would result in clearing many disputed titles, and saving large amounts now annually wasted in litigation, and render the recording of deeds and plots of some real use and value, not only for the present, but for all future generations.

Untold acres have descended from the past generation in litigation or are held by the present heirs by most slight tenure, on account of the faults which it is the object of this paper to help to remedy.

All land owners are interested in a matter of so much moment to them and their heirs, and even the spilling of human blood would often have been saved had a law something like this been in force a hundred years ago.

It is suggested that the civil engineers and surveyors of the country, through the societies, unite in framing and presenting a memorial on this subject to the different State legislatures, recommending the passage of acts for the guidance of all the county and city registers that would be uniform throughout the whole country.

One beneficient result would certainly be the nipping of many wildcat land speculations and a feeling of security which would enhance the valuation of all real estate.

It would also have a tendency to weed out a class of ignorant "hoe-handle" surveyors who have outlived their usefulness, and with their old-fashioned open-sight compasses should be relegated to the attic with the family spinning wheel and other relics of our grandfather's days, where, at least, they can do no harm and can indulge in reminiscences of "now when I was a boy" or in utter oblivion to the stupendous way that the country has outgrown them.

## AMERICAN ENGINEERING AND CONTRACTING PLANT.

With this issue we give our readers the first of a proposed series of working drawings of "American Engineering and Contracting Plant." We wish to make this feature a purely practical one, by presenting only such tools as have stood the test of actual use, and are latest in date and most approved in form; we believe that, by so doing, we will fill a gap in American engineering literature, for all present published data upon this subject, is very meagre and widely scattered. As far as the size of our paper will permit, we intend to give sufficient detail, to enable any one to actually construct the machine, to estimate its cost, to fill out a "bill of materials."

We have heard it remarked that "any man can build a derrick, frame a head-house over a shaft, or put a few timbers, upon which to erect an iron bridge," but speaking from experience, we believe that drawings, showing how the thing has been done by some one else, will at least materially assist us in our own designs and calculations, we can always modify a plan to adapt it, to controlling circumstances.

The Derrick illustrated in this number is one in common use on large public works, and was built by the writer, and, with others similar to it, actually used in handling 32,000 cu. yds. of bridge masonry. Having in mind our own failure in a search for approved forms and dimensions, in works devoted to engineering, and the trials and breakages that occurred before all parts were adapted to their work, we had careful measurements made, and now present them to our readers. The full details with dimensions will be given next week. As showing the value of experience, in so common an article in contracting plant, as a derrick, we might call attention to the shrunk-band on the "gudgeon-pin" in the head of the mast. The omission of this band, at first-thought useless, coupled with the carelessness of a workman in boring the hole *too deep*, was the cause of an ugly accident on our own work. This pin gradually worked downward, until its top barely held the guy-iron or "spider," and being far overhead, this fact was unnoticed, until one day the vibration, incident to the hoisting of a very heavy stone, caused the mast to slip out from under its support, and fall, seriously injuring several workmen; after this experience, we put on the band, making us independent of a workman's auger.

## THE OHIO SURVEYORS AND ENGINEERS ASSOCIATION.

The programme for the annual meeting will be one of unusual interest. The addresses have been carefully prepared and will be interesting to every surveyor and engineer. The time that the Association will be actually in session during the three days has been made short in order to give members an opportunity for social intercourse and to examine the maps, plats, blanks, and surveying and engineering instruments that will be exhibited. To those who contemplate purchasing instruments during the coming year an opportunity to examine the different instruments will no doubt be of value to them in making such purchase. It is generally supposed that the members of this Association are all county surveyors, but such is not the case. Many of our most energetic members are ex-county surveyors, and we have had assistance from many who are not nor ever have been county surveyors. Our efforts have never been for the benefit of a single class alone, but for the entire profession.

There seems to be an almost unnanimous sentiment in favor of so altering our constitution and by-laws that they will better harmonize with the work and object of the Association, which is "for mutual benefit and for the advancement of the profession." At the present time our services are often regarded in the light of manual labor rather than professional service. There may be surveyors who are so incompetent as to merit nothing better. But there is a class of surveyors and engineers in this State doing what is called a "mixed business;" that is, all kinds of surveying and engineering, which forms a part of every county's public works—men whose opinion of road, ditch and many other laws are held in high estimation. Such men should be better paid. Their ability is not paid in proportion to other men of equal ability in other professions. We ask all such men to sacrifice a few days and join us in our labors to help one another.

We have never held a session with closed doors; everybody is welcome at all times. The basis of membership will no doubt be extended to all practical surveyors and engineers in Ohio during the first part of the coming meeting.

A standard of qualification, similar to those of Attorneys, Physicians, Teachers and other professions, is the first step of progress, without which we will never as a profession reach a higher standard. A bill designed for this purpose is now before the Legislature, which it is believed will eventually work to the advantage of every surveyor who expects to make surveying a business; it will increase the business of the County Surveyor's office, and give dignity to those who are not County Surveyors and make their work of importance. We can see no reason why this bill should not receive the support of every surveyor and engineer in the State. If you are of like opinion do not fail to help us. Just at this time a few words from each surveyor would settle the matter of its passage. It is similar to the plan adopted in Canada and the Old Countries, and is found to be the most successful system.

Let Ohio be among the first States to advance.

Finally, we assure you that you will not regret the time it will cost you to meet with us. Your association, if but a short time, with men of like occupation and of like thoughts, will be both pleasant and profitable. To extend your acquaintance with men of the same profession throughout the State will also be of value.

Could the surveyors and engineers of Ohio who have not been present at any of our meetings fully understand their benefits, we are confident that nothing but the most urgent circumstances would prevent them from being present.

Respectfully, FRED J. SAGER,
President Ohio Surveyor's Association
Marysville, Ohio.

## THE SONG OF THE ADVERTISER.

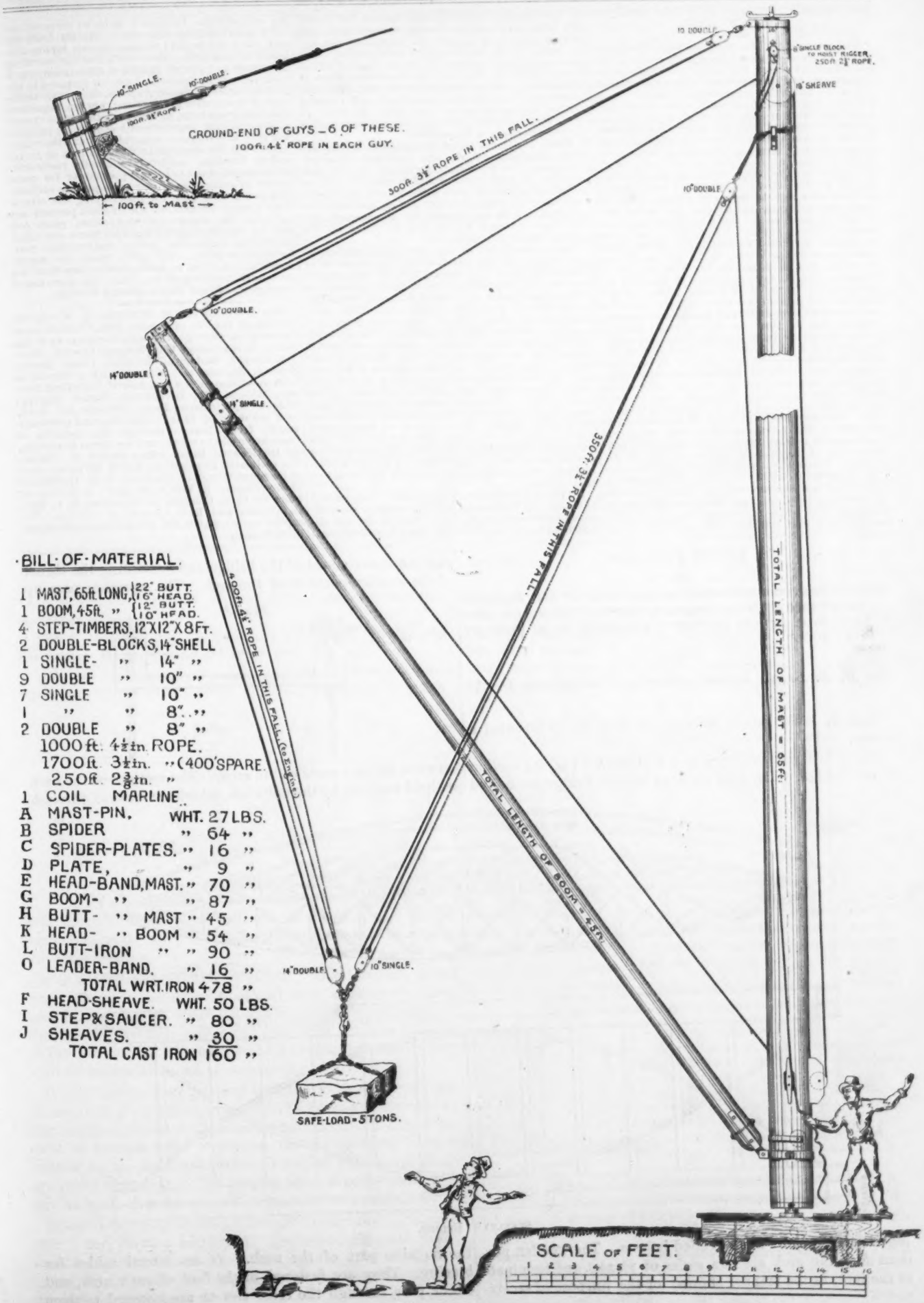
[From the Denver Tribune.]

I am an advertiser great!
In letters bold and big and round,
The praises of my wares I sound:
Prosperity is my estate.
The people come,
The people go,
In one continuous,
Surging flow—
They buy my goods and come again,
And I'm the happiest of men;
And this the reason I relate,
I am an advertiser great!

There is a shop across the way,
Where ne'er is heard a human tread,
Where trade is paralyzed and dead,
With ne'er a customer a day.
The people come,
The people go,
But never there,
They do not know
There's such a shop beneath the skies,
Because he does not advertise;
While I with pleasure contemplate,
That I'm an advertiser great.

The secret of my fortune lies
In one small fact, which I may state,
Too many tradesmen learn too late—
If I have goods I advertise!
Then people come,
And people go
In constant streams,
For people know
That he who has good wares to sell
Will surely advertise them well;
And proudly I reiterate,
I am an advertiser great!

BUYING WAY FOR A PIPE LINE.—Parties representing the Transit Oil Pipe Line Company of Cleveland, Ohio, were at Lebanon on the 5th and called upon a number of land-owners with the view of purchasing a right, of way and to settle damages for their pipe line, which is to run along the county line between Lebanon, Schuylkill and Berks. Information from Mifflin states that a corps of civil engineers hailing from Elmira, N. Y., surveyed a line, to locate the pipe line, running from Treverton to Reading, which will pass through the Lebannon Valley. It is expected to lay the pipe from 18 to 24 inches under the ground, so as not to interfere with the tilling of the soil. The purchase of the ground was made on Tuesday and Wednesday. The parties paid twenty-five cents per rod.


10" SINGLE.
10" DOUBLE.
100ft. 3½" ROPE.
GROUND-END OF GUYS—6 OF THESE.
100ft. 4½" ROPE IN EACH GUY.
100 ft. to MAST
10" DOUBLE
8" SINGLE BLOCK TO HOIST RIGGER. 250ft. 2⅜" ROPE.
18" SHEAVE
300ft. 3½" ROPE IN THIS FALL.
10" DOUBLE
10" DOUBLE.
14" DOUBLE
14" SINGLE.
350ft. 3½" ROPE IN THIS FALL.
TOTAL LENGTH OF MAST = 65ft.
400ft. 4½" ROPE IN THIS FALL. (6 Sheaves)
TOTAL LENGTH OF BOOM = 45ft.
14" DOUBLE
10" SINGLE.
SAFE-LOAD = 5 TONS.
SCALE OF FEET.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

## BILL OF MATERIAL.

| | | |
|---|---|---|
| 1 | MAST, 65ft. LONG, | 22" BUTT. 16" HEAD. |
| 1 | BOOM, 45ft. " | 12" BUTT. 10" HEAD. |
| 4 | STEP-TIMBERS, 12"X12"X8Ft. | |
| 2 | DOUBLE-BLOCKS, 14" SHELL | |
| 1 | SINGLE- " 14" " | |
| 9 | DOUBLE " 10" " | |
| 7 | SINGLE " 10" " | |
| 1 | " " 8" " | |
| 2 | DOUBLE " 8" " | |
| | 1000 ft. 4½ in. ROPE. | |
| | 1700 ft. 3½ in. " (400' SPARE. | |
| | 250 ft. 2⅜ in. " | |
| 1 | COIL MARLINE. | |
| A | MAST-PIN. | WHT. 27 LBS. |
| B | SPIDER " | 64 " |
| C | SPIDER-PLATES. " | 16 " |
| D | PLATE, " | 9 " |
| E | HEAD-BAND, MAST. " | 70 " |
| G | BOOM- " " | 87 " |
| H | BUTT- " MAST " | 45 " |
| K | HEAD- " BOOM " | 54 " |
| L | BUTT-IRON " " | 90 " |
| O | LEADER-BAND. " | 16 " |
| | TOTAL WRT. IRON | 478 " |
| F | HEAD-SHEAVE. | WHT. 50 LBS. |
| I | STEP & SAUCER. " | 80 " |
| J | SHEAVES. " | 30 " |
| | TOTAL CAST IRON | 160 " |

BOOM DERRICK.

## THE WATER SUPPLY AND THE STREETS OF NEW YORK.

No department of the city government has supervision of so much that immediately concerns the comfort, convenience and health of citizens as the Department of Public Works. The more important of its duties as prescribed by statute are as follows: The Department of Public Works shall have cognizance and control of all structures and property connected with the supply and distribution of Croton water; of opening, altering, regulating, grading, flagging, curbing, guttering and lighting streets, roads, places and avenues; of the care of public buildings, including the buildings known as the county court-house buildings; of public sewers and drainage; of paving, repairing and repaving streets, and keeping the same clear of obstructions, and of the relaying of pavement removed for any purpose. Referring you to the exhaustive quarterly reports made by the Commissioner of Public Works to the Mayor, the last of which will be found in the *City Record* of Saturday, Dec. 30, for a statement in detail of the management of the multifarious affairs of this department, I shall at this time call your attention only to one or two matters of paramount interest.

From time to time for several years past the proper officers of the city government have called the attention of the Common Council and of the State Legislature to the necessity for an increased supply of pure water for domestic, manufacturing and other purposes, and in doing so have stated their reasons therefor so frequently and so fully that it seems unnecessary for me to repeat them to you. Moreover, the experience of our citizens in all parts of the city respecting their supply of water is such that no argument is needed to convince them of the urgency and importance of the subject. When it is remembered that in the summer and autumn of 1881 the city barely escaped the calamity of a water famine, and when it is borne in mind that the dwellings, manufacturing establishments and other structures built and commenced since that time are fully equal in extent to 5,000 houses—which the city undertakes to supply with pure and wholesome water—some idea may be gained of the present position of the city in regard to its water supply, and possibly some conception of the magnitude of the disaster which would befall the city with the recurrence even of conditions no worse than those of 1881. The city government has no more important and pressing matter for consideration than this. In view of these circumstances, prompt and vigorous action in two directions is imperative:

First. The most effective measures to suppress waste should be adopted and vigilantly enforced.

Second. The legislation necessary to the construction of such works as will furnish the city an abundant supply of pure water should be secured with the least possible delay; and an increased demand should be anticipated, far in excess of any that has occurred within the 40 years of the Croton aqueduct's existence.

The construction of the dam and aqueduct, as contemplated in the report of the Commissioner of Public Works to the Mayor, Feb. 23, 1882, would involve the expenditure of a large amount of money (estimated at $14,000,000), and would require several years for completion. This plan, indorsed by many eminent engineers, is possibly the best that has been proposed, and is probably the best that can be devised. At the same time it would, in my opinion, be wise, before finally adopting any plan, to have the opinion of business men, as well as engineers, concerning its practicability, the probable cost, and the time required for construction. The execution of whatever plan may be adopted should be surrounded with proper safeguards against extravagance or unnecessary expenditure; to this end, I believe you will join me in the recommendation that to a controlling extent the work be supervised by men of known integrity who possess some practical knowledge of such matters.

No little inconvenience has of late been caused to travel and to business by the general disturbance of the streets in the lower part of the city incident to the laying of steam pipes by steam heating companies. Inasmuch as these corporations have received their franchises directly from the city, they can be held responsible only for due diligence in prosecuting their work and for restoring the streets to a proper condition after the laying of their pipes is completed. I am not prepared to say that in either of these respects they have transcended the powers given them; but an important question arises here, namely, whether some system of general city improvement cannot be adopted whereby this frequent upturning of our thoroughfares, with its consequent disturbances of travel and of business, may not be wholly prevented. Here would seem to be an opportunity for some person of enterprise or for some private corporation to mature a plan for underlaying the streets with a single excavation which shall provide not only for the water, gas and steam pipes, but also for telegraph and telephone wires and other appliances which the public convenience may hereafter require. The space under the streets would thus become as susceptible of benefit to the citizens as rapid transit has made the space above the streets.—*From Mayor Edson's Message.*

CHICAGO, OSWEGO & WESTERN R. R.—Incorporated on the 5th, at Topeka, Kan. To start from the city of Oswego, through the counties of Labette, Montgomery, Chautauqua, Cowley, Sumner, Harper, Barbour, Comanche, Clark, Meade, Seward, Stevens and Kansas, with a branch or branches through the counties of Crawford, Neosho, Wilson, Elk, Greenwood, Butler, Harvey, Sedgewick, Kingman, Pratt, Edwards and Ford, to a point at or near Dodge City, and northeastwardly from Oswego through the counties of Cherokee and Crawford, and thence to Pettistone, on the Missouri River, with a branch to Clinton. The estimated length of the line is 600 miles; place of business, Oswego; directors, J. M. Hedden, of Coffey; George E. Wiley, of Dorr; J. B. Ellis, of Minerva; C. M. Condon, B. Whorkins, H. C. Hall, L. S. Crum and R. H. Carper, of Oswego. The capital stock is $3,000,000, divided into 50,000 shares of $100 each.

## TRUSS BRIDGES.

AN ILLUSTRATED HISTORICAL DESCRIPTION OF ALL EXPIRED PATENTS ON TRUSS BRIDGES, WHICH UNDER THE LAW ARE NOW PUBLIC PROPERTY AND FREE TO BE USED BY ANY ONE.

*By F. B. Brock, Patent Attorney, Washington, D. C.*

Sept. 2, 1851, Edwin Stanley, of New York, invented a bridge.

Fig. 1 is a perspective, Fig. 2 a plan, and Fig. 3 a section of the bridge. The iron portions of the bridge are bolted together with short flush-headed bolts *o*. The wooden portions *E* of the arch are of a series of planks, and terminate at the foot, in the manner shown, for the purpose of receiving the lower chord of the bridge and sustaining the thrust of the wooden portions of the arch. The uprights pass up between the two parts of the arch. The sections of the arch are held together by the bolts *n n*, which are screwed through the metallic part of the arch. *H* are lateral cables for bracing. They are fastened at the foot of each arch, and either pass through the cross ties or are fastened to them

Fig. 3.

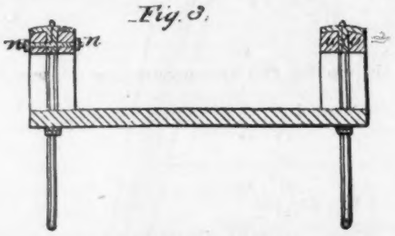



Fig. 1.

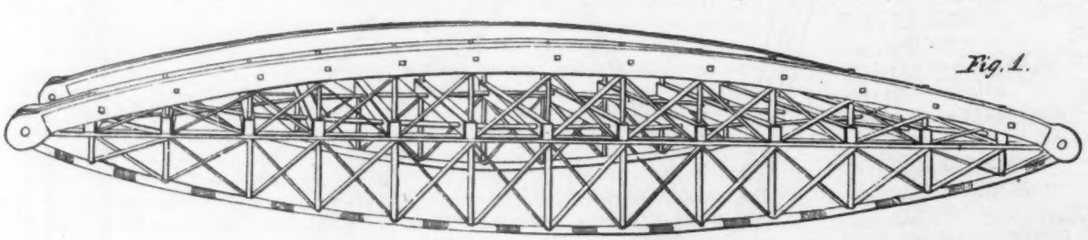
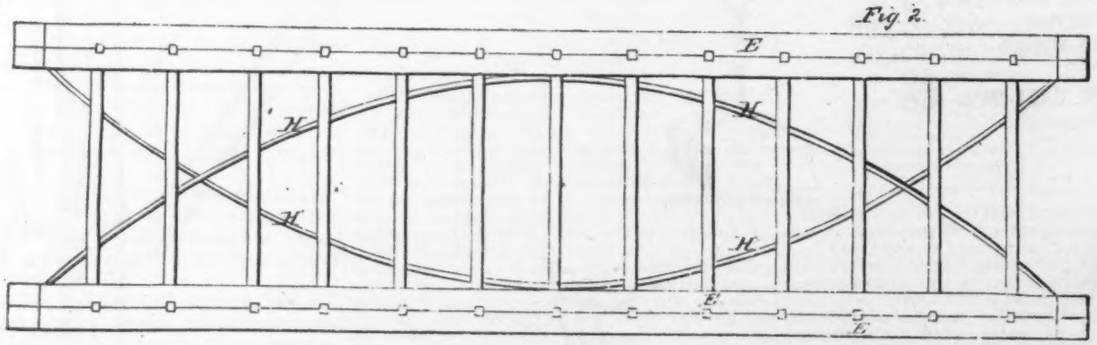
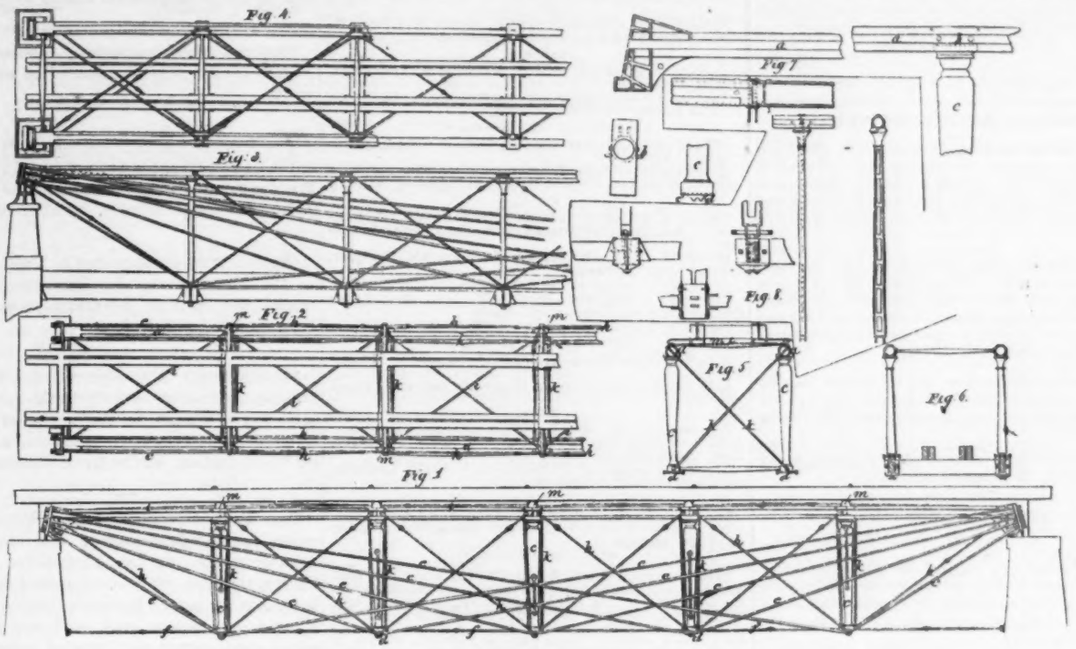


Fig. 2.




STANLEY'S BRIDGE.

on the under side. They are nsed to prevent the bridge from being thrown out of line laterally, which is important for railroad bridges placed on curves. The arch is so arranged that one side of the wood work of each arch can




BOLLMAN'S BRIDGE.

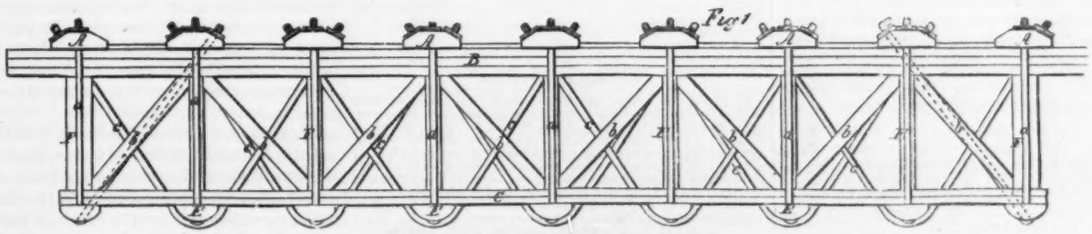
be removed and replaced without disturbing or weakening the other side.

Jan. 6, 1852, August Bollman, of Maryland, constructed the bridge shown by the accompanying drawing.

Bollman arranged the truss so as to carry the whole load upon the bridge at any given point (at the center or either

July 6, 1852, Bradway & Valentine, of Massachusetts, invented the truss, shown by Figs 1, 2, 3 and 4.

The diagonal braces *b* are so arranged that each shall reach from the bottom of one post to the top of the next post, and the ends of the two adjacent braces shall be opposite to one another, and alternately at the top and bottom of a post. The upper chords *B* are then laid, without uniting, upon the posts and braces. The saddle blocks *A* are next placed upon the upper stringers. *a* are the ties. One end of the tension braces *b* are inserted through a saddle block,




BRADWAY & VALENTINE'S BRIDGE.

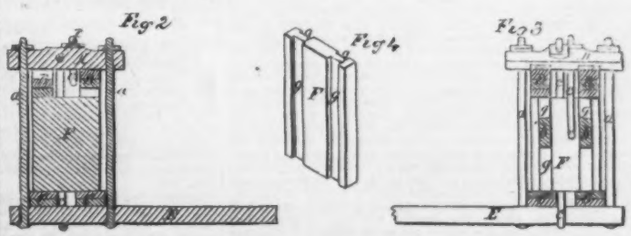
side thereof) directly back to the abutments, and at the same time retain all the forces of thrust and tension within the truss frame.

*a* is a sectional tubular stretcher. The pendant struts *c* are affixed to the stretcher *a*, and have a recess $c^1$ fitting in the shoe *d*, with space enough to slide longitudinally of the frame. Tension rods *e* run from this point to the end of the structure at the abutment; and each strut is furnished with an independent set of such rods.

It will thus be seen that any load that each and every one of the struts are required to bear will be directly transferred to the abutment without the intermediate action of any other strut or tension rod, Moreover, the longitudinal force is resisted by the stretcher without bringing any lateral strain upon the abutment. The sliding shoe *d* compensates for any unequal expansion in the tension rods or stretcher.

Brace rods *f* may be used to steady the struts *c*. Diagonal rods *h* may be also employed. Horizontal diagonal rods *i* should be introduced where the roadway is above the stretcher, as in Fig. 1, and there may be cross braces *k* in the vertical cross section.

and, after passing under the cross-joint situated directly below the next saddle, pass up through the next saddle beyond. The straining up of the tension braces is by the usual nuts and screws. The whole bridge is thus tied firmly by these tension braces, crossing and drawing in opposition




to one another. The inventors consider the chief advantage to consist in constructing it without tenons or mortises, so that the chords may slide upon the other parts sufficiently to adapt themselves to the expansion and contraction of material consequent to changes in the temperature.

This bridge is intended to be built of iron.

(TO BE CONTINUED.)

# ENGINEERING NEWS
AND
## AMERICAN CONTRACT JOURNAL.

Tribune Building. New York City.

The Engineering News Publishing Company, Proprietor.
GEO. H. FROST, Treasurer.

SATURDAY, JANUARY 13, 1883.


## EDITORIAL ANNOUNCEMENTS.

**Terms of Subscription.**—To the United States and Canada, $4 per annum, including postage; all parts of Europe and Mexico, $5, payable in advance. Remittances at the risk of the subscriber, unless made by registered letter or by draft, check or P. O. order, payable to GEO. H. FROST.

**Terms of Advertising.**—One inch, 12 lines, one insertion, $2; one month, $6.50; three months, $17; six months $30; one year, $50. Special rate for large space and long time will be given on application. Advertisements inserted for less than three months, payable in advance; for longer time, payable quarterly.

**Articles for Publication** in the current number should be received at the office of publication not later than Thursday morning, and advertisements not later than Friday noon.

**Correspondence** upon subjects which naturally belong to the province of this journal is solicited.

### CLUBBING ARRANGEMENTS.

1883.

In order to accomodate such of our subscribers as may wish to subscribe for other periodicals we offer the following terms: We will send to any address ENGINEERING NEWS at regular subscription price, $4.00, and the following at the additional prices given:

| | Net Price. | Reg. Price. |
|---|---|---|
| Atlantic Monthly | $3.25 | $4.00 |
| Century Magazine | 3.55 | 4.00 |
| Harper's Magazine | 3.25 | 4.00 |
| Harper's Weekly | 3.25 | 4.00 |
| Harper's Bazar | 3.25 | 4.00 |
| Harper's Young People (weekly) | 1.25 | 1.50 |
| St. Nicholas Magazine | 2.55 | 3.00 |
| North American Review | 4.00 | 5.00 |
| Our Continent | 3.25 | 4.00 |

The principal change in the above figures from those of last season is in that of the *Century Magazine*, which has advanced its trade price correspondingly. Our purpose is to bring the trade of our subscribers into this office, and to do his we give the clubbing journals at trade price and we add five cents to pay for stamps, stationery and time in handling the business. We wish it understood that we will extend this arrangement to any desired journal in the United States, so that our subscribers need not pay any attention to the claims of solicitors, who cannot offer any better terms.

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### NOTICES OF MEETINGS.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—The annual meeting of the Society will be held Jan. 17 and 18, 1883, at the Society house. The meeting will open Wednesday Jan. 17, at 10 a. m. The annual reports will be presented, officers elected, proposed amendments to the Constitution discussed, reports from committees on technical subjects presented and discussed. The award of the Norman medal for the past year will be announced. The paper recently read before the Society by Mr. William P. Shinn, M. Am. Soc., C. E., on the "Increased Efficiency of Railways for the Transportation of Freight," will, by resolution of the Society be in order for discussion. It is expected that business may occupy the morning session, and that discussion on Mr. Shinn's paper, and other technical questions, will begin at the afternoon session. Lunch will be served at the Society house at 1 p. m. After lunch, the session will be resumed at 2:30 p. m., and, if found desirable, an evening session will also be held. For Thursday, arrangements will be made for visits to a number of interesting works. A detailed programme is in preparation by a committee, and will be announced at the beginning of the session of Wednesday. On Thursday evening, at eight, a reception for gentlemen will be held at the house of the Society, after which supper will be served in the library.

JOHN BOGART, Secretary.

COUNTY SURVEYORS' ASSOCIATION OF INDIANA.—The annual meeting of the association will be held at the County Surveyor's office, in the Court House, at Indianapolis, beginning on the 16th of January, 1883. Addresses on different subjects in regard to surveys, ditches and gravel roads are expected to be delivered, which will be of interest to the Indiana surveyers. An interesting meeting is expected.

HERVEY B. FATOUT,
Corresponding Sec'y.

THE MICHIGAN ASSOCIATION OF SURVEYORS AND ENGINEERS.—The Fourth annual meeting of the above association will be held at the State Capital, Lansing, Michigan, on January 9-12, 1883

PROGRAMME.

TUESDAY, JAN. 9.—2. P. M.

Association called to order. Reading of minutes. Committee to examine surveyors' instruments appointed.

3 P. M.

Legislative needs of our profession.—Paper by George E. Steele, Grand Traverse. General discussion.

7.30 P. M.

Address of President, Prof. C. E. Greene of Ann Arbor. General discussion.

Construction and care of our common roads; by Burton Kent of Adrian. General discussion.

WEDNESDAY, JAN. 10.—9 A. M.

Difficulties in city surveying.—A. J. Teed, City Engineer, Cadillac. Discussion.

Construction and care of water-works suitable for small cities in Michigan.—Chas. B. Hyde, City Engineer, Jackson.

2 P. M.

Method of projecting parallels of latitude.—H. C. Pearsons, U. S. Inspector of Steam Vessels, Ferrysburg. Discussion.

Questions in practice.—I. H. Leavenworth, Engineer, Saginaw City. Discussion.

7.30 P. M.

Surveying instruments.—Prof. J. B. Davis, Ann Arbor. Remarks by manufacturers and others.

Report of Committee on Instrument Exhibit.

THURSDAY, JAN. 11.—9 A. M.

Reports of committees.—The manual; legislation. Discussion.

Railroading in Utah.—Frank Hodgman, Engineer, Climax Discussion.

2 P. M.

Construction and operation of narrow-gauge railroads.—A. L. Reed, Chief Engineer P. H. & N. W. R. R., Port Huron, Mich. Discussion.

Logging railroads of Michigan.—E. F. Guild, Engineer, East Saginaw, Mich. Discussion.

7.30 P. M.

Traverse surveying.—Prof. J. B. Davis, Ann Arbor, Mich.

Engineering of town and county drains.—S. N. Beden, Engineer, Pine Run.

QUESTIONS OF PRACTICE.

In order to avoid waste of time it is important that such questions be arranged and given some consideration before our next meeting. Mr. I. H. Leavenworth, of Saginaw City has kindly undertaken this task. It is to be hoped that enough queries will be submitted to cover most of the difficult points in practice Questions on which the opinion of the Association is desired should be sent at once to Mr. Leavenworth or the Secretary.

EXHIBIT OF SURVEYING INSTRUMENTS.

By a special vote of the members at the last meeting an exhibit of surveying instruments will be held at our coming meeting. We invite each member to exhibit his instrument of practice, whether good or poor, and shall provide proper place for such an exhibit. We especially invite manufacturers to exhibit instruments of their own make. If they can attend our meeting personally, we offer them a place on our programme. To our members we will say that we hope to induce one or two of the most noted manufacturers to be present with us.

ENTERTAINMENTS.

The hotels in Lansing will give the following rates to members of the Association:

| | |
|---|---|
| Lansing House | $2.00 per day. |
| Hudson House | 2.00 " |
| Chapman House | 1.25 " |
| Goodrich House | 1.25 " |
| Everett House | 1.00 " |

INDUCEMENTS TO ATTEND.

Each member of the association should arrange his work so that he can be in attendance throughout the whole meeting. The advantages to be attained may be stated briefly as follows: Mutual instruction, which in time will be evident in a more uniform practice; acquaintance and good feeling toward fellow laborers, which cannot be estimated in money; an opportunity, at small expense, to see the attractions of the State capital during a session of the Legislature.

Surveyors or engineers, not members, should embrace this opportunity for joining the association.

PROF. H. C. CARPENTER, Lansing, Mich., Secretary.

AMERICAN INSTITUTE OF MINING ENGINEERS.—The annual meeting of the Institute will be held in Boston, beginning Tuesday, February 20, 1883. A subsequent notice will give the detailed programme of the meeting. Members are requested to give early information to the Secretary of their intention to read papers at this meeting.

THOMAS M. DROWN,
EASTON, Pa., Dec. 27, 1882. Secretary.

ILLINOIS TILE MAKERS' ASSOCIATION.—The fifth annual meeting of the Association will be held at the State House, Springfield, January 16 and 17, 1883:

PROGRAMME.

*Tuesday, 10 o'clock a. m., January 16.*—Address of Welcome by Gov. S. M. Cullom. Roll Call. Reading Minutes of last Meeting. Reports from Members as to the interest in Tile Drainage in their respective localities.

*Afternoon Session.*—Receiving Reports of Officers. Benefits of Farm Drainage, by Prof. Geo. E. Morrow, Illinois Industrial University. Discussion. Clays and their Management, by Prof. G. S. Tiffany Tecumseh, Minn. Discussion.

*Evening Session.*—Kilns—Construction and their Management, by J. E. Landrum, Hebron, Ohio. Discussion. Question Box.

*Wednesday Morning.*—Sanitary Influence of Drainage, by John H. Rauch, M. D., Secretary Illinois State Board of Health. Arrangements for making Tile in Winter—A. Horrocks, Bardolph, Ill. Roofing Tile—Manufacture of, by J. W. Penfield, Willoughby, Ohio. Difficulties in Making Large Tile, and how Obviated, by Alex. Huey, Dwight, Ill. Question Box.

*Afternoon Session.*—Road Drainage, by S. T. K. Prime, Dwight, Ill. Improvement of Soil by Drainage, by C. G. Elliott, Tonica, Ill. Election of Officers. Adjournment.

Tile makers are requested to send to S. D. Fisher, Secretary State Board of Agriculture, the names and post-office addresses of all the tile makers in the county in which they reside. Arrangements have been made with the leading railroads centering in Springfield, for reduced rates.

The annual meeting of the Ohio Institute of Mining Engineers will be held on January 17, 1883, at 7 P. M., at the office of the Inspector of Mines, in the State House, Columbus, Ohio.

A full attendance of members is earnestly requested. Many matters of importance will be before the meeting.

As our meetings are public, all those interested in the objects of the Institute are invited to attend, especially mining engineers, geologists, chemists, students of mining schools, metallurgists, metallurgical engineers, and persons practically engaged in operating and working mines.

R. S. PAUL, Secretary. A. ROY, President.

Two new advertisements of interest to Water-Works Contractors are published elsewhere this week.

THE METROPOLITAN IRON WORKS, JULIUS JONSON & CO. of this city, has been changed to the JONSON FOUNDRY & MACHINE COMPANY. The officers are Julius Jonson, president; Julius Elson, treasurer.

CONTRACTORS are requested to note the change in the advertisement for Durango, Col., Water-works, the time for receiving proposals having been extended to Feb. 1.

TRANSACTIONS AM. SOC. C. E.—The October number is given up entirely to the subject of Preservation of Timber, in the shape of Reports of Committees; letters from members, and a paper by W. P. Judson, on the Kyan Process.

THE EAST RIVER BRIDGE.—We reprint this week, from "Bradstreet's," the most complete popular article on the East River Suspension Bridge, that has yet been presented to the public. It is from the pen of Rudolph Hering, M. A. S. C. E., who, by previous good work, has proven himself a most correct and careful writer upon engineering topics. The article covers the whole progress of the work, from its incorporation in 1867 to the present date, and gives in a compact form all the chief points, dates, dimensions, cost, etc.; and, in view of its early completion, some very timely remarks upon its stability, effects of unequal loading, and its commercial value to the city of New York.

INSTRUCTIONS FOR FINDING THE TRUE MERIDIAN BY THE NORTH STAR (POLARIS), arranged for Engineering students and Surveyors, by Olin H. Landreth, Professor of Engineering, Vanderbilt University. This is the title of a large sheet of instructions, conveying the information outlined therein, and it will be sent free to surveyors on application to Professor Landreth, Vanderbilt University, Nashville, Tenn. It has beside the instructions for finding the meridian, a Table of Eastern and Western Elongations, and a Table of Azimuths, the latter computed for the intervals between 1882 and 1930, which will probably suffice for the needs of even the most juvenile member of the surveying profession now in practice. Elsewhere in this week's issue we publish Table I. from Professor Landreth's "Instructions."

THE week has been full of important events, mostly casualties. The *City of Brussels*, of the Inman Line of steamers, was sunk in a collision off the coast of Ireland with a total loss of vessel, cargo, and eight persons. The State Treasurer of Tennessee, Marshall T. Polk, after stealing all the spare funds of the State absconded for Mexico, but was captured and brought back to Nashville. He threatens lively "exposures" of high official peculation. The Newhall House, Milwaukee, was completely destroyed by fire on the morning of the 10th, with a loss at latest estimates of 110 persons burned or killed. Mr. Garret S. Boice, a Jersey City Bank President, literally "cleaned out" one bank of which he was President, and broke another of which he was Treasurer. There has been a severe snow storm extending from the Atlantic westward to the whole of the Northwestern States, and as we go to press the streets of this city are blockaded with impeded travel caused by the snow, which, however, is being hauled from the principal thoroughfares by the Street Cleaning Department as rapidly as possible. The weather is very cold.

## ENGINEERING NEWS PUBLISHING COMPANY.

This journal will hereafter be published by "The ENGINEERING NEWS Publishing Company," a corporation formed under the general incorporation laws of this State, and articles of which were filled in the office of the Secretary of State in Albany, on the 12th inst. The capital stock is $50,000, divided into 1,000 shares of $50, all of which is held by the present working staff of the paper, the members of which form the Board of Trustees for the present year.

The management remains exactly as heretofore, except that Mr. D. MC N. STAUFFER is added to the active working force and assumes a very responsible position. As a civil engineer he has had a wide, practical experience in almost every branch of the profession, and he is already so well known that he does not need any further introduction to the readers of this journal; and it is to secure for the patrons of ENGINEERING NEWS the rare combination of professional experience and artistic and literary abil'ty, possessed by Mr. STAUFFER, that the writer has relinquished a portion of his interest in the journal of which he has taken a pride in being sole owner hitherto. It is intended that profuse illustration will be *the* feature of this journal hereafter.

MR. S. D. V. BURR remains as assistant editor. MR. CROES will hasten the completion of the "History and Statistics of American Water-Works" as rapidly as the careful collection of his material will permit; the great work in which he is specially engaged is daily assuming an importance which was not anticipated at the start, and with the publication in book form of the matter now appearing in weekly installments, a permanent department will be formed, which will each year bring together all that is new and valuable in the construction and management of water-works.

The subscription and advertising department is in charge of Mr. CHAS. E. TIEL. There is no traveling solicitor for this journal.

The general management will continue with the writer, who is always at his desk in business hours and always glad to see the patrons who have helped so liberally to bring this journal to what it is. We have made a better newspaper each year of the past nine, and we intend to do a great deal better than we have ever yet done. We have just added four pages of reading matter; the contributions of Mr. STAUFFER will be in the direct line of actual practice; all machines or works illustrated will be with the purpose as far as possible of giving working drawings for the use of engineers and contractors; we intend to publish more than ever before the news of projected or completed works, of the doings of the societies, of the movements of individual engineers, elections and appointments, besides publishing as many of the best papers on engineering subjects as we can find space for; the correspondence in practical subjects that has always an interest as coming direct from the actual need or practice of the profession will continue to find a place in our columns, while in our advertising pages we expect to illustrate how useful a well-conducted class journal may become to its patrons.

The past year was the most prosperous one in the history of this journal; but this year opens on prospects even brighter than the past. Our subscription list presents a most satisfactory weekly growth; we feel quite proud of the amount and respectability of our advertising patronage, and we have been a good deal flattered by the unsolicited acknowledgments of the merits of our journal as an advertising medium. We have, also, a constantly growing book trade, for which we are very thankful to our subscribers.

We have endeavored to build up a strong, influential and useful journal by doing the best we could to promote the interests of *all* our patrons, and by always treating them with reciprocal liberality. We have an increasing admiration for engineers, as we know them more intimately as a body. We cannot conceive of a class of men, taken all in all, whom it would be more pleasant to serve than those whose tastes in journalism we do our best to study and gratify, and, if we may judge from the excessively small percentage of loss which *we* have sustained each year through the delinquency of our patrons, we believe that to no other body of men in the country could the financial administration of large public undertakings be so safely intrusted as to the civil engineering profession.

We are much obliged for past favors, and we hope in the present and future years greatly increased mutual profit may arise from a continued and enlarged acquaintance between us and the civil engineers and contractors of America.

## ENGINEERS AS BUSINESS MEN.

IN speaking of the heavy expenditure of money involved in the construction of the proposed dam and aqueducts for the New York Water Supply, reprinted to-day, Mayor Edson makes the remark that, while the plan is indorsed by many eminent engineers, and is probably the best that can be devised, "it would be wise, before finally adopting any plan, to have the opinion of business men, *as well* as engineers." The italics are ours, and while the Mayor may not have intended to state that engineers were not business men, it so appears by implication. The history of the progress of all civilized races proves most emphatically that the great engineers were most successful business men as well. The handling of money, the sinews of all business, enters into his province as much as does the handling of material. And in many cases that we might cite, the discrepancies existing between the "probable cost" and ultimate outlay, on some large public work, may be set down as much to extensive knowledge of men, and shrewd business tact, as to a want of sufficient preliminary data, or to so-charged "professional blundering." Had Mr. Chesbrough, when called in to devise a plan of drainage for the flat and muddy city of Chicago, commenced operations by telling them that the only way out of their difficulties was by lifting the town, with all its heavy buildings, bodily, ten feet into the air, he would probably have been laughed at, and his entire scheme condemned. But he realized the magnitude of the work before him, and the fact that the purely *business* men of Chicago could not appreciate the situation, and so he gradually led them on to the only possible solution of the problem. Mr. Eads has made his great fame, as much by manipulating men, and leading them to invest large sums of money, as by actually bridging the Mississippi, for without the capital the work would never have been accomplished. And to come nearer home, how many think we would now have a bridge over the East River, had the "business men" of New York and Brooklyn known, in 1867, that such a structure would cost them $15,000,000.

A marked characteristic of the American investor, is, that when a public work of general benefit is once fairly launched, and a considerable sum invested, he will rarely allow it to fail for lack of means. He gradually becomes educated to the necessities of the case, and if required, will go deeper and deeper into his pocket, pride combining with self-interest to hasten its completion; he will growl but pay the bills.

The engineer may be accused of sometimes taking advantage of this weakness; if we can call it a weakness, but to imply that true engineering and executive ability, only another term for "business," do not go hand in hand, is a proof either of want of knowledge, or of thought.

If any further proof is needed, take a list of the men who control and manage the successful railways of our land, and see how many of them commenced life as engineers. Thos. A. Scott, J. Edgar Thompson, A. J. Cassatt, and the present chief, Geo. B. Roberts, of the Pennsylvania Railroad, were all, at one time, civil engineers, and the list could be swelled indefinitely.

## PERSONAL.

W. R. MORLEY, late Chief Engineer of the Mexican Central, was buried at Las Vegas, N. M., on the 7th.

MR. S. T. FULLER has resigned his position as General Superintendent and Chief Engineer of the Mexican National and Texas Mexican roads, after a period of arduous service in the organization of the working staff of those lines and in their location and construction. Mr. Fuller was formerly Chief Engineer of the Philadelphia, Wilmington & Baltimore, and is well known as an engineer of ability and experience.

GEN. EGBERT L. VIELE, one of the new Park Commissioners, was born in Waterford, N. Y., June 17, 1825, and was graduated from the West Point Military Academy in 1847. He served through the Mexican War as a lieutenant of infantry, and resigned from the army in 1853, when he was appointed State Engineer of New Jersey. In 1857-58 he was Engineer-in-Chief of the Central Park, and in 1860 of Prospect Park, Brooklyn. During the war he was a Brigadier-General of Volunteers, and he has since been a civil engineer in this city. He has published a number of papers on scientific subjects. His connection with politics has not been active.

## OBITUARY.

GEN. THEODORE G. ELLIS died at Hartford, Monday evening last at the age of 53. He was in early life a civil engineer at Boston and did much surveying for the New England railroads. In 1854 he went to Connecticut as assistant engineer on the western extension of the Hartford, Providence and Fishkill Railroad, and had charge of the layout and building of that road through Bristol and Plymouth. He afterward went out to Mexico in charge of a surveying party in the interest of Boston capitalists, and spent two or three years there in surveying routes, prospecting mining lands, etc. He established himself as a surveyor in Hartford in 1861, but in June, 1862, he joined the 14th Connecticut as adjutant. He rose to the rank of brevet brigadier-general during a most creditable career, Chancellorsville, Antietam and Cold Harbor being among the battles in which he participated. After the war he returned to Hartford. In 1869 he made the surveys for the improvement of the Connecticut River, the first work being done the following year under his charge, and all subsequent improvements were made under his direction. He was elected a member of the American Society of Civil Engineers February 17, 1869, and was a vice-president of it from 1873 to 1877.

## ELECTIONS AND APPOINTMENTS.

Appointments in the Engineering Department of railroads are not given for publication as frequently as they should be. We will be pleased to receive notification of the changes, re-appointments, or additions made in the engineering department of any railway, city, or other incorporation, in the country. The chief engineer of a railway holds a very responsible position, and a great many people wish to know the names of the men who are responsible for the maintenance of the railroad tracks of the country.

DENVER AND NEW ORLEANS.—Mr. C. W. Fisher has been appointed general manager, with office in Denver, Col.

ILLINOIS CENTRAL.—James C. Clarke, late President of the Southern lines has been appointed general manager of the entire road and its branches.

LOUISVILLE AND NASHVILLE.—Mr. F. W. Vaughan was, on January 1st, appointed consulting engineer of this company, and Mr. Milton H. Smith was appointed general manager of all lines operated by this company, vice Mr. F. de Funiak, resigned,

COMMISSIONER OF HIGHWAYS.—JOHN D. ESTABROOK, C. E., was elected by Councils, Chief Commissioner of Highways for the city of Phila-

delphia. The duties of this office are, the construction of streets, bridges, and sewers, and the maintenance of the same, including street cleaning. The designing of public works, except such as directly relate to streets and sidewalks, do not belong to his office; all general and detail plans being made in the office of another official, the City Engineer.

NEW YORK RAILROAD COMMISSION.—The Governor of New York on January 10 sent to the Senate the following names as Railroad Commissioners: John D. Kernan, of Utica; William E. Rogers, of Putnam County, and John O'Donnell, of Lewis County.

William E. Rogers was born in Philadelphia in 1846. He entered the West Point Military Academy in 1863, was graduated No. 6 in his class in 1867, and was commissioned lieutenant in the United States Engineer Corps. He was immediately ordered to duty on a survey of Lake Superior and the surrounding region. He then resigned from the army in October, 1869, and since then he has been engaged in his profession as a civil engineer. He was employed by the Delaware, Lackawanna & Western Railroad Company in laying out and constructing the extension of their road from Birmingham to Buffalo, but left their service in 1881. He is appointed as a Republican and as the experienced railroad man of the Commission, according to the law.

John D. Kernan, the Democratic member of the Commission, was born in Utica, 1844. He was graduated from Seton Hall College, New Jersey, in 1863, whereupon he entered upon the study of law, and on his admission to the bar in 1866 began practice with his father, ex-Senator Kernan, and a brother in Utica. He has since that time been engaged in the active practice of his profession. He has been regarded as one of the most laborious and promising lawyers in the central part of the State. Though an active and pronounced Democrat he has never held a political office.

John O'Donnell, the Anti-Monopoly member of the Commission, is about 50 years old and is a jornalist and a politician, and is a resident of Lowville, Lewis County. He represented his Senatorial district in 1868 and 1869, and was clerk of the Assembly in 1873 and 1874. During the discussion of the Railroad Commission Bill last winter he attended closely upon the sessions of the Legislature and was undoubtedly of no inconsiderable influence in securing a passage of the bill as it now is. He was a member of the Commission nominated under the terms of the law by the Board of Trade and Transportation and other organizations.

PITTSBURGH, CHARTIERS & YOUGHIOGHENY.—Joseph Ramsay, Jr., has been appointed General Manager and Chief Engineer.

DANVILLE AND NEW RIVER RAILROAD.—S. F. Adams is Chief Engineer, and John A. Holt Superintendent of Construction.

## THE EAST RIVER SUSPENSION BRIDGE.

BY R. HERING, MEM. AM. SOC. C. E.

One of the most important of modern engineering works, both from a commercial and a scientific aspect, is rapidly approaching completion. The great bridge which is to unite the cities of New York and Brooklyn, and has been building for the last thirteen years, will be thrown open to the public during the coming spring. While its completion will credit American enterprise and engineering with the greatest success in modern bridge-building, it will also be a potent factor in contributing to the development of the center of American commerce.

The idea of building the bridge originated some twenty years ago, but it did not take a tangible shape until Jan. 25, 1867, when the late Hon. H. C. Murphy introduced an act in the Senate to incorporate the New York Bridge Company, empowering it to construct and maintain a permanent bridge over the East River, and authorizing the two cities to subscribe to the capital stock such amounts as two-thirds of the respective common councils should determine. The act was passed April 16 of the same year. On May 23 John A. Roebling, who had successfully built the two longest-span bridges in existence, those, namely, at Niagara and Cincinnati, was appointed chief engineer. In his first report, dated September 1. 1867, he recommended a suspension bridge with 1,600 feet span, and substantially outlined the present structure and set forth its practicability. His project was novel and daring. It represented so important an interest and so large an investment that the directors deemed it advisable to obtain an indorsement from other members of the profession. Accordingly, in May, 1869, a report was presented to the board by Horatio Allen, B. H. Latrobe, W. J. McAlpine, James P. Kirkwood, and other eminent engineers, who, after a careful examination, substantially approved of the plans in general and in detail. In the same month a commission of three government engineers, General Wright, General Newton and Major King, was appointed, in compliance with an act of Congress, to report with regard to the bridge being an obstruction to navigation. These gentlemen likewise indorsed the scheme in the main, but recommended an increase of five feet for the clear headway under the central span and a few minor changes.

Thereupon arrangements were at once made to begin work. On Jan. 3, 1870, the ground was broken by tearing out the north slip of Fulton Ferry, to prepare for the foundation of the Brooklyn tower. The first wire rope was stretched across the river Aug. 14, 1876; the last one, completing the cables, was run over Oct. 5, 1878. In the meantime the approaches were put under way at such times that all parts of the bridge would be simultaneously finished. A change of organization was effected in 1874, when the original stock company was bought out by the cities of New York and Brooklyn, and the completion of the bridge placed in the hands of a board of twenty trustees, the mayors and comptrollers of the two cities being of the number. The original estimate of the cost was set down at about $7,000,000, exclusive of the necessary real estate, which was valued at about $3,000,000 in addition, and it was expected to have the bridge finished in five years. But unforseen difficulties, as well as many changes in the design which suggested themselves from time to time, and have now brought out a very different and more useful and substantial bridge than the one originally intended, have raised the actual cost to nearly $15,000,000, which sum, however, after the resale of some property, is to be reduced to about $13,400,000, excluding interest. The time of construction has been about thirteen years. The benefits which are expected to accrue to both cities from this gigantic undertaking are sufficiently great to make the large investment a paying one.

The development of a city is stimulated by both external and internal causes. The one is represented by its geographical position with reference to the resources of its wealth and to its facilities for commerce, the other by the facility offered to the transaction of business within the town. The degree to which the latter is obtained depends not only upon the intelligence and enterprise of the inhabitants, but directly on the comparative ease and rapidity of transfer between its districts. It is undeniable, both from our own and European experience, that the larger a city, the more convenient, quick and safe must be the means of communication in it, if it is to compete with other large and more favored centers of population. A good system of street alignments, conveyances, telegraphs, etc., all tend to shorten distance and time between points that are frequented. In connection with this the advantage accruing to New York from the elevated railroads, by allowing a much greater amount of business to be transacted in a day than formerly, may be mentioned. The East River bridge must have a similar effect. The saving of time in crossing the bridge from points beyond its termini will be almost fifteen minutes, leaving out of consideration the additional detention on the ferries due to ice and fogs. We might, therefore, assume that a great part of Brooklyn will be moved as much nearer to New York as one can travel in a quarter of an hour. The effect which such an approach of two large centres of population will have must be at once beneficially felt in both cities.

The bridge is of the suspension order. The towers upon which the suspending cables rest are situated immediately at the two shores, and form a span of 1,595 ft., which is 50 per cent. greater than any heretofore attempted. The faces of the anchorages which hold the ends of the cables are located 930 ft. from the centers of the towers. The bridge, therefore, has three spans in a distance of 3,460 ft.; including the approaches it is nearly 6,000 ft. long. The height of the towers above high-water is 288 ft., or 346 ft. and 312½ ft. above their foundations respectfully, which latter measure 170 ft. long by 102 ft. wide. The anchorages are 89 ft. high, 129 ft. long and 110 ft. wide at the base. The masonry in the towers measures up to the enormous amount of 85,000 cubic yards; that in the anchorages to 66,000 cubic yards. The roadway is 85 ft. wide, and is supported by four cables, each of which is 15¾ in. in diameter and contains 5,434 wires, measuring in the four cables 14,060 miles, or more than half the distance around the earth. The wire in the four cables is of steel and weighs nearly 3,500 tons. The permanent weight of the river span is 6,740 tons; the greatest transitory load is estimated at 1,380 tons, making the total weight of the loaded span 8,120 tons.

The travel over the bridge is to be accommodated in the following way: Six trusses extend along the entire bridge to give it increased strength and stiffness. They divide it into five sections. The two outer ones are each sufficiently wide to allow for two lines of vehicles. The next two are reserved for cars, and the center section is to be the footway. The latter measures 15 ft. 7 in. in width in the clear, and is elevated so that an unobstructed view is obtained, while telegraph wires and pipes for various purposes occupy the space beneath. The cars are to run across the bridge on the principle recently applied to the traction of city passenger cars in some streets of Chicago and Philadelphia, namely, that of attaching them at will to a continuously moving wire rope. The speed of this rope will be maintained at about ten miles an hour. It is intended to run cars at very frequent intervals, say, of one or two minutes, thus avoiding a tedious delay at the station. The estimated time of crossing the bridge on the cars is seven minutes. The rate of fare has not yet been determined upon. Pedestrians will cross free of charge. The open spaces in the anchorages and under the many arches of the approaches leading to them will be utilized as warehouses. The present terminus of the City Hall branch of the elevated railroad, which stands directly at the end of the bridge, will likely be removed from its obstructing position as soon as arrangements have been adjusted to enable the cars to cross the bridge. A few years ago it was suggested to prepare the bridge for the reception of Pullman cars, the heaviest and largest now in use. Although this entailed a considerable increase of weight and expense, Colonel Roebling consented to the change, on the reflection, "Of what benefit has it been to erect this bridge at a vast expense unless we use it for every possible purpose to which the structure will lend itself?"

In view of the advent of the opening of the bridge and of the value it represents, both in the sums of money expended and in the benefits to be derived, it will be interesting to consider some of the most important features on which its success depends. The serious results that would follow its destruction—a not unnatural supposition in view of such recent disasters as the fall of the Tay bridge—could be somewhat realized should we suddenly be deprived for years of the rapid transit furnished by the elevated roads. In the first place, the stability of the bridge depends on that of the towers, which, including their own weight, exert the enormous pressure of 86,000 tons each upon their foundations. At the floor line the pressure is 26 tons per square foot; at the surface of the water it is only 13½ tons, owing to the larger sectional area, and at the base, where it has again more than double the area, the pressure is 6½ tons per square foot. To insure a uniform distribution of the weight it was necessary to use solid timber platforms, respectively 15 and 22 ft. thick, 170 ft. long and 102 ft. wide, upon which to found the piers. Wood when immersed in salt water is imperishable, and to protect it against sea-worms it is merely necessary to sink it beneath the river bed. To give it a firm and even bedding it was necessary to excavate the bottom of the river to a considerable depth. To do this the pneumatic method was used, according to which the water at the bottom of the river is driven out from under a vessel of the size of the contemplated foundation by means of compressed air, and thus enabling the men to work, as it were, in a large diving-bell.

Owing to the fact that the caissons—formed for this purpose below the just mentioned platform—were much larger than any heretofore built, many novel features and difficulties arose. Extreme care was taken to make them air-tight by calking all the seams, and, besides, by covering the entire caisson with a vast sheet of tin, unbroken throughout. The surface of the interior chamber, in which the men were to work, was coated, in Brooklyn, with a varnish to prevent the air from escaping through the pores of the wood, and in New York with a thin boiler-plate lining, riveted and calked so as to be air-tight, and as a protection against fire, which had at one time threatened the destruction of the Brooklyn caisson. A bottom of very great hardness was finally reached. At the Brooklyn side it was 44 ft., at the New York side 78 ft., below high water. The caisson was filled up solidly with masonry and concrete. The stone-work built upon the platform was mainly granite, a small portion being limestone. The interior stones were all laid in level courses and squared. Only 8 per cent. of the bulk of the towers was taken up by the joints which were carefully filled with concrete. At important points all stones were tied with iron cramps. Never before were piers built of such vast dimensions and with more care and caution than these two monuments of American skill. Now, after nearly the entire weight is placed upon them, the total settlement has been no more than what is due

to the natural shrinkage of the material—about one inch from the time of reaching high water.

Next in importance is the superstructure. The longest span ever before attempted was 1000 ft.—in the bridge at Cincinnati. While in theory the afety of so large a span as nearly 1,600 ft. is unquestioned, it was advisable in practice to use every possible precaution. The wire is of steel and its manufacture was carefully inspected. The cable making was done probably with more care than ever before, in order to obtain a perfectly uniform strain throughout. To guard against corrosion, each wire was galvanized with zinc and coated with oil and the cables were wrapped closely with wire and painted with white lead. Their strength can be estimated as follows: The factor of safety of the material is 3½, *i. e.*, to tear the cables it would take 3½ times the greatest weight that can be placed upon them. The weight of the bridge itself is five times that of the estimated greatest transient load. The breaking strain of the cables could therefore not be reached until the transient load is over twenty times the greatest expected amount. In fact, as the factor of safety of the anchorages is only 6, the cables before breaking would be more than strong enough to lift them up from their foundations. Their rigidity, further, is such that it takes several hundred tons to move them up or down perceptibly.

One of the most serious difficulties to be contended with is the maintenance of the balance of the spans during unequal loading, and the prevention of excessive motion of the cables in the saddles on the towers. This motion will be relieved by the friction of the rollers, the resistance and support of the trusses, which are continuous through the towers, and by the action of 432 stays radiating from the top of the towers 350 feet in both directions, which alone could carry a large part of the whole load. To stiffen the structure against vibrations due to the travel or to severe storms, 6 trusses extend the whole length of the bridge, and floor beams, or the supporting trusses of the roadway, placed every 7½ feet, extend across its full width. Horizontal stays and ties are likewise used to add to the stiffness wherever possible. A danger to the bridge from overweighting or from strong winds is not be feared. Heavy oscillations, due to a regular step in crossing, can be avoided by regulation, although this danger becomes less to be feared the larger and heavier the bridge. The greatest peril to be expected is that of a large conflagration under or near the bridge, as the heat could greatly impair and even destroy the strength of the cables. This danger is to be guarded against by controlling the adjacent property and prohibiting the storage thereon of inflammable material. A further precaution will be taken by leading a perforated pipe along the cables, from which they can be wet in case of necessity. The construction of the approaches, though not comparing in difficulty or novelty with that of the bridge itself, offered many problems which had called out the ingenuity of the engineers. With a most searching investigation into all the dangers to the bridge and the means of their avoidance, and with as careful an execution of the work as has been given any large work of our times, there need be no fear of its failure, and there can be no doubt that the expected benefits will be realized and permanently maintained.

It may finally be interesting to examine into some of the effects which the completion of the bridge will have in changing certain existing conditions. The most important effect will be caused by the shortening of time in the transfer between the two cities, beyond the bridge termini, to the extent of from ten to fifteen minutes. This saving of time between the business centers of the cities will naturally tend to increase communication in proportion, and, as a consequence, the amount of business done. The greater rapidity with which New York can be reached by those residing in Brooklyn will either increase the time desirable for rest or add to the time available for business. A second effect will be the more rapid growth of Brooklyn eastward, for it will take less time to reach New York from many districts that are not yet built up than it does now from many that are well settled. Temporarily, we may even expect a reaction in the growth of other districts around New York. In the city itself, owing to the position of the bridge terminus, there must be caused a further tendency to draw the center of business still more northward. An expected increase in the value of property near the bridge will probably be due not only to the fact of its proximity to the same, but to the restrictions to be placed upon a certain tract of land below the bridge, and about 200 ft. in width, in order to prevent any extensive conflagration, which would seriously injure the cables, and therefore the entire bridge. This immunity will doubtless have its special value. The usefulness and safety of the extensive room for storing merchandise under the approaches to the bridge will tend to draw into the neighborhood a business not heretofore carried on in the same localities.

The opening of the bridge will undoubtedly decrease the ferry traffic in its vicinity for a time. But the decrease can neither be great nor enduring. The communication between the large strips of land on each side of the river lying below the termini of the bridge will not be affected by it, and will always supply a considerable trade, while the bridge will mainly accommodate the higher and more distant parts. The ferries are also likely to retain most of their goods traffic, especially if its destination is along either bank of the river, because of the desire to avoid the grade in crossing the bridge. The grade, however, is comparatively slight, being only 3¼ ft. in 100 ft., or somewhat less than that on Wall street, between Broadway and Nassau street.

It still remains to mention a few points regarding the effect of the bridge on the river traffic. Assertions have been made at times that it would be an obstruction. The clear headway at the center of the bridge at high water is 135 ft.; at low water 140 ft. No permanent standing rigging of any ship would, therefore, at any time reach above the bottom of the bridge floor. The span admits of the unobstructed passage of all schooners, barks, brigs and steamers, as well as ships carrying less than 1,000 tons. Those with greater tonnage will have to lower some of their upper detachable spars. An estimate indicates that this proportion is from 3 to 4 per cent. of the craft ordinarily lying along the East River, and that hardly one in two hundred of the passing vessels would have to strike any of the spars. This number will even constantly diminish as the commerce of the world is carried on more and more by steamers. The increase of cost, and the permanent inconvenience to the bridge traffic by increasing the grade and height beyond the present, would therefore not have been justified. The bridge is to be thrown open to the public by degrees—*i. e.*, pedestrians will be able to cross it in March, the carriage ways will be finished in April, and the railroad will be completed during the summer.

The final success of this great work in its engineering features is due to the skill and perseverance of the following gentlemen: The first chief engineer and originator of the scheme was John A. Roebling, of Trenton, N. J.. He lost his life in consequence of an injury received while engaged in making the preliminary surveys of the work, and was succeeded by his son, Col. W. A. Roebling, the present Chief Engineer. Mr. C. C. Martin, the principal Assistant Engineer, has acted as general superintendent. Col. W. H. Paine was placed in charge of the superstructure, the cable making, and the roadway. Messrs. F. Collingwood and S. R. Probasco have had charge of the New York approach, and George W. McNulty of the Brooklyn approach. The office work and the designs of details have been done under the direction of Mr. Hildenbrand, and the practical work connected with the cable making and superstruction has been supervised by Master Mechanic Mr. E. F. Farrington.—*Bradstreet's Journal.*

## THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page* 10.)

CCCCLVI.—KENTON, O.

Kenton, Ohio, in lat. 40° 35′ N. long. 84° 40′ W. is on rolling ground, on the Scioto River.

Settled in 1820, it was incorporated in 1838.

Water-works were built for a private company in 1881, by the Holly Manufacturing Co., taking the supply from a well 20 ft. in diameter and 24 ft. deep, sunk in limestone rock. The water is pumped by a Holly steam pump, directly into the mains, with 40 lbs. ordinary and 100 lbs. fire pressure. Distribution is by five miles of cast-iron pipes of 16 to 4 in. in diameter with 42 fire hydrants, 7 gates and 100 taps. The town pays $100 per year for each hydrant. Service pipes are of lead.

The population in 1880 was 3,940. The daily consumption is not given.

The capital stock of the company is $60,000. The works have cost $58,216.87. The bonded debt is $40,000 at 6 per cent. interest. The expenses in 1882 were $2,386.95 and the receipts $3,522.58. E. V. Boulton is the Manager.

CCCCLVII.—DECORAH, IA.

Decorah, Iowa, in lat. 43° 15′ N., long. 91° 45′ W., on the Iowa River, is on rolling ground.

Settled in 1854, it was incorporated as a city in 1875.

Water-works were built by the city in 1881, after plans prepared by the City Clerk, E. Mather. The supply is taken from a well, 20 ft. in diameter, sunk 30 ft. in porous saturated gravel in the river valley. The water is lifted 240 ft. by a Knowles steam pump, with 16-in. steam and 8-in. water cylinders of 12-in. stroke, to a reservoir, 60-ft. in diameter and 20 ft. deep, built of stone laid in cement, with a concrete bottom. When first tested, this reservoir emptied itself suddenly, and was then re-plastered. Provision is also made for direct pumping.

Distribution is by 1¼ miles of cast-iron pipe of 8 and 6-in. diameter, with 14 fire hydrants, 7 gates and 7 taps. Service pipes are of wrought-iron.

The population in 1880 was 2,951.

The works went into operation in February, 1882. The cost was $22,483.72. The bonded debt is $20,000, half at 6 and half at 5 per cent. interest.

The works are managed by a committee of the City Council. R. B. Tuttle is the Chairman.

CCCCLVIII.—MCKEESPORT, PA.

McKeesport, Pennsylvania, in lat. 40° 20′ N., 70° 52′ W., is at the junction of the Monongahela and Youghiogheny rivers, 752 ft. above sea level, on hilly ground, rising from the river to a height of over 300 ft.

Settled in 1795, it was incorporated as a borough in 1842. Its limits were extended in 1847 an 1873.

Water-works were built by the borough in 1881-82, after plans of Hatch & Taylor, Civil Engineers, taking the supply from the ground-water by a well 28 ft. in piameter, on the bank of the Youghiogheny River, at the upper end of the turn. The well is 32 ft. deep, and 36 cast-iron perforated 4-in. pipes are driven 10 ft. deeper in the saturated gravel. A 20-in. pipe conveys the water 70 ft. from the well to the engine house, whence two Worthington duplex high-pressure pumping engines, each of 1,500,000 gallons capacity, force it through 1,547 ft. of 16-in. pipe to a reservoir in excavation and embankment 226 ft. square and 20 ft. deep, 310 ft. above the river. The reservoir bottom is covered with 6-in. concrete on 12-in. puddle. The slopes are paved with 10-in. stone blocks, laid in cement on 8 in. of broken stone on 12 in. of puddle.

A 1-in. pipe leads from the reservoir to the pump house, so arranged that when the reservoir is full the pipe fills and blows a steam whistle as a signal to stop pumping.

Distribution is by 9 miles of cast-iron pipe of from 12 to 4 in. diameter, with 70 fire hydrants, 76 gates and 210 taps.

The population in 1880 was 8,212. The works were completed in July, 1882, at a cost of $98,-304.45. The bonded debt is $75,000 at 5 per cent. interest. The expenses of maintenance to Dec. 1, 1882, were $1,036.48, and the receipts $2,246.90.

The works are managed by a committee of five members of the council. Joseph Ecoff is the Superintendent.

CCCCLIX.—SOUTHBRIDGE, MASS.

Southbridge, Massachusetts, in lat. 42° 5′ N., long. 72° 3′ W., is on the Quinabay River on level ground surrounded by hills.

Water-works were built in 1880 by a private company, after plans of Buttrick & Wheeler, taking the supply from springs and the water shed of a small brook. An earth dam 240 ft. long and 10 ft. high forms an impounding reservoir 200 ft. wide and 230 ft. long between two hills 100 ft. above the village.

Distribution is by 2¼ miles of cast-iron pipe of from 12 to 4 in. diameter, with 17 fire hydrants, 5 gates and 50 taps. The town pays $300 per year for hydrant service. Service pipes are of wrought-iron.

The population in 1880 was 4,000. The daily consumption is not known.

The capital stock of the company is $10,000. The works cost $17,000. The bonded debt is $7,000, at 5 and 6 per cent. interest. No further financial statistics are given.

H. J. Conant is the Clerk and Treasurer.

TO BE CONTINUED.

The receipt of statistics, as follows, is acknowledged with thanks:

From Robert Mood, Superintendent, statistics of Topeka, Kansas, water-works.

From Ralph Bent, Superintendent, statistics and report of Cochituate Village, Wayland, Mass., water-works.

From W. B. Douglas, Secretary, statistics, report and water rates of Fargo, Dakato, water-works.

From Nathan Shelton, Proprietor, statistics of Freeport, Illinois, water-works.

From Ellis B. Noyes, statistics of Brockton, Mass., water-works and report for 1880.

From P. H. Baermann, statistics of Coopers town, N. Y., water-works.

BALTIMORE & PHILADELPHIA RAILROAD.—Incorporated this week to run from a point on the boundary line between Delaware and Pennsylvania, in Upper Chichester Township, Delaware County, Penn., to the city of Philadelphia, a distance of twenty-one mile; capital stock, $1.200,-000; Directors—Thomas M. King, Alleghany, City; John M. Cleave, Pittsburg; Harry S. Burgesser, Pittsburg; Robert Garrett, John W. Davies, John K. Cowen, Baltimore; and Wilham S. Bissell, Alleghany City. President—James B. Washington of Alleghany City.

## THE FLOW OF WATER THROUGH PIPES.

EDITOR ENGINEERING NEWS:

During the past season I have had occasion to require the discharge of a great many pipes of different diameters and slopes, and prepared the following table, which at first embraced only those which I then required.

Since then I have extended the table to include pipes of greater and less diameters and slopes, for the use of an engineering friend.

This table is made up from the second category of Darcy's channel formula, which I considered as applicable, not to smooth, clean pipes, but those which had been oxidated internally by a few years' use.

The table is simply the result of tedious logarithmic calculations. I have made it without assistance, but have performed all of the calculations twice, and think that it contains no errors.

The discharges for the same sized pipes are as the square root of the slope, or in this case inversely as the square roots of the denominators of the slopes. The table can, therefore, be used for other slopes than those given in the inverse ratio of the square roots of the denominators.

Darcy's usual pipe formula is for clean, smooth pipes, and gives a little less discharge than the table for pipes of less than 18 in. diameter, and a little more discharge for those of more than 18 in.

Yours, WM. J. MCALPINE.

TABLE OF DISCHARGES OF PIPES. BY THE DARCY FORMULA $V = \sqrt{\frac{RS}{0.000057\left(1+\frac{0.23}{R}\right)}}$ = C. FT. PER SECOND, WHERE R (HYDRAULIC RADIUS) = AREA ÷ CIRCUMFERENCE, OR ¼TH OF THE DIAMETER.

DIAMETERS IN INCHES.

| SLOPES. | 2″ | 3″ | 4″ | 6″ | 8″ | 10″ | 12″ | 15″ | 18″ | 20″ | 24″ | 30″ | 36″ | 42″ | 48″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 in 10 | 0.073 | 0.237 | 0.544 | 1.72 | 3.87 | 7.19 | 11.87 | 21.82 | 35 68 | 50.96 | 77.00 | 138.97 | 224.31 | 335.50 | 475.67 |
| 50 | .032 | 0 106 | 0.2428 | 0.77 | 1.73 | 3.21 | 5.31 | 9.77 | 15.96 | 22.79 | 34.44 | 62.14 | 100.31 | 150.04 | 212.73 |
| 100 | 0.023 | 0.075 | 0.1721 | 0.54 | 1.22 | 2.27 | 3.75 | 6.90 | 11.28 | 16.12 | 24.35 | 43.95 | 70.93 | 106.09 | 150.42 |
| 200 | 0.016 | 0.053 | 0.1217 | 0.38 | 0.86 | 1.61 | 2.65 | 4.88 | 7.98 | 11.40 | 17.22 | 31.07 | 50.16 | 75.02 | 106 36 |
| 300 | 0.013 | 0.043 | 0.0991 | 0.31 | 0.71 | 1.31 | 2.18 | 3.98 | 6.51 | 9.30 | 14.06 | 25.37 | 40.95 | 61 25 | 86.85 |
| 400 | 0.011 | 0.037 | 0.0860 | 0.27 | 0.61 | 1.14 | 1.88 | 3.45 | 5.64 | 8.06 | 12.18 | 21.97 | 35.47 | 53.05 | 75.21 |
| 500 | 0.010 | 0.033 | 0.0788 | 0.24 | 0.55 | 1.02 | 1.68 | 3.09 | 5.05 | 7.21 | 10.89 | 19.65 | 31.72 | 47.45 | 67.27 |
| 600 | 0.009 | 0.031 | 0.0702 | 0.22 | 0.50 | 0.93 | 1.53 | 2.82 | 4.61 | 6.58 | 9.94 | 17.94 | 28.96 | 43.31 | 61.41 |
| 700 | 0.008 | 0.028 | 0.0650 | 0.21 | 0.46 | 0.86 | 1.41 | 2.61 | 4.26 | 6.09 | 9.20 | 16.61 | 26.81 | 40.10 | 56.86 |
| 800 | 0.0 8 | 0.026 | 0.0608 | 0.19 | 0.43 | 0.81 | 1.32 | 2.44 | 3.99 | 5.70 | 8.61 | 15.54 | 25.08 | 37.51 | 53.18 |
| 900 | 0.007 | 0.025 | 0.0574 | 0.18 | 0.41 | 0.76 | 1.25 | 2.30 | 3.76 | 5.37 | 8.12 | 14.65 | 23.64 | 35.36 | 50.14 |
| 1,000 | 0.007 | 0.024 | 0.0544 | 0.17 | 0.39 | 0.72 | 1.19 | 2.18 | 3.57 | 5.10 | 7.70 | 13.90 | 22.43 | 33.55 | 47.57 |
| 2,000 | 0.005 | 0.017 | 0.0385 | 0.12 | 0 27 | 0.51 | 0.84 | 1.54 | 2.53 | 3.60 | 5.45 | 9.83 | 15.86 | 23.72 | 36.63 |
| 3,000 | 0.004 | 0.014 | 0.0314 | 0.10 | 0.22 | 0.41 | 0.69 | 1.26 | 2.06 | 2.94 | 4.44 | 8.02 | 12.95 | 19.37 | 27.46 |
| 4,000 | 0.003 | 0.011 | 0.0272 | 0.09 | 0.19 | 0.36 | 0.59 | 1.09 | 1.78 | 2.55 | 3.85 | 6.95 | 11.22 | 16.77 | 23.78 |
| 5,000 | 0.003 | 0.010 | 0.0243 | 0.08 | 0.17 | 0.32 | 0.53 | 0.98 | 1.60 | 2.28 | 3.44 | 6.21 | 10.03 | 15.00 | 21.27 |
| 1 m. 5,280 | 0.003 | 0.010 | 0.0237 | 0.075 | 0.17 | 0.31 | 0.52 | 0.95 | 1,55 | 2.23 | 3.35 | 6.05 | 9.76 | 14.60 | 20.70 |
| 6,000 | 0.002 | 0.010 | 0.0222 | 0.07 | 0.16 | 0.29 | 0.48 | 0.89 | 1.46 | 2.08 | 3.14 | 5.67 | 9.16 | 13.70 | 19.42 |
| 7,000 | 0.002 | 0.009 | 0.0205 | 0.06 | 0.15 | 0.27 | 0.45 | 0.82 | 1.35 | 1.93 | 2.91 | 5.25 | 8.48 | 12.68 | 17.98 |
| 8,000 | 0.002 | 0.008 | 0.0192 | 0.06 | 0.14 | 0.25 | 0.42 | 0.77 | 1.26 | 1.80 | 2.72 | 4.91 | 7.93 | 11.86 | 16.82 |
| 9,000 | 0.002 | 0.008 | 0.0181 | 0.06 | 0.13 | 0.24 | 0.40 | 0.73 | 1.19 | 1.70 | 2.56 | 4.63 | 7.48 | 11.18 | 15.86 |
| 10,000 | 0.002 | 0.0075 | 0.0172 | 0.05 | 0.12 | 0.23 | 0.38 | 0.69 | 1.13 | 1.61 | 2.44 | 4.39 | 7.09 | 10.61 | 15.04 |
| 15,000 | 0.002 | 0.0061 | 0.0140 | 0.04 | 0.10 | 0.19 | 0.31 | 0.56 | 0.92 | 1.32 | 1.99 | 3.59 | 5.33 | 8.66 | 12.28 |
| 20,000 | 0.002 | 0.005 | 0.0122 | 0.04 | 0.09 | 0.16 | 0.27 | 0.49 | 0.80 | 1.14 | 1.72 | 3.11 | 5.02 | 7.50 | 10.64 |
| 50,000 | 0.001 | 0.003 | 0.0077 | 0.03 | 0.05 | 0.10 | 0.17 | 0.31 | 0.50 | 0.70 | 1.09 | 1.97 | 3.17 | 4.74 | 6.73 |
| 100,000 | 0.00073 | 0.002 | 0.0054 | 0.02 | 0.04 | 0.07 | 0.12 | 0.22 | 0 36 | 0.51 | 0.77 | 1.39 | 2.24 | 3.35 | 4.76 |

DIAMETERS OF PIPES IN FEET.

| SLOPES. | 4½′ | 5′ | 5½′ | 6′ | 6½′ | 7′ | 8′ | 9′ | 10′ | 12′ | 15′ | 20′ | 30′ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 in 10 | 643.81 | 845.03 | 1,080,02 | 1,350.58 | 1,658.33 | 2,004.75 | 2 819.75 | 3.807.33 | 4,977,49 | 7,907.52 | 13,912.97 | 28,770,97 | 252,557.30 |
| 50 | 287.92 | 377.91 | 483.00 | 603.99 | 741.62 | 896.56 | 1,261.04 | 1,702.27 | 2,226.03 | 3,536.31 | 6,222.14 | 12,866.49 | 112,948.40 |
| 100 | 203 59 | 267.22 | 341.53 | 427.09 | 524.41 | 633.96 | 891.68 | 1,203.98 | 1,574.02 | 2,500.58 | 4,399.67 | 9,098.09 | 79,865.64 |
| 200 | 143.96 | 188.96 | 241.50 | 302.00 | 370.80 | 448.28 | 630.52 | 851.33 | 1,113.01 | 1,768.15 | 3,111.07 | 6,433.24 | 56,474 19 |
| 300 | 117.54 | 154.28 | 197.18 | 246.58 | 302.77 | 366.02 | 514.81 | 695.12 | 908.76 | 1,443.71 | 2,540.07 | 5,252.79 | 46,110.52 |
| 400 | 101.80 | 133.61 | 170.77 | 213.55 | 262.20 | 316.98 | 445.84 | 601.98 | 787.01 | 1,250.29 | 2,199.83 | 4,549.04 | 39,982 82 |
| 500 | 91.05 | 119.51 | 152.74 | 191.00 | 234.52 | 283.52 | 398.78 | 538.43 | 703.93 | 1,118.28 | 1,967.61 | 4,068.74 | 35,717.41 |
| 600 | 83.12 | 109.09 | 139.43 | 174.36 | 214.09 | 258.82 | 364.03 | 491.52 | 644.08 | 1,020.85 | 1,796.18 | 3,714.24 | 32,604.68 |
| 700 | 76.95 | 101.00 | 129.09 | 161.42 | 198 21 | 239.62 | 337.02 | 455.06 | 594.92 | 945.13 | 1,662.92 | 3,438.75 | 30,186.31 |
| 800 | 71.98 | 94.48 | 120.75 | 151 00 | 185.40 | 224.14 | 315.26 | 425.67 | 556.51 | 884.08 | 1,555.50 | 3,216.63 | 28,237.09 |
| 900 | 67.86 | 89.07 | 113.84 | 142.36 | 174.80 | 211.32 | 297.25 | 401.33 | 524.67 | 833.53 | 1,466.56 | 3,032.70 | 26,621.96 |
| 1,000 | 64 38 | 84.50 | 108.00 | 135.06 | 165.83 | 200.47 | 281.97 | 380.73 | 497.75 | 790.75 | 1,391.30 | 2,877.07 | 25,255.73 |
| 2,000 | 45.52 | 59.75 | 76.37 | 95.50 | 117.26 | 141.76 | 199.39 | 269.22 | 351.97 | 559.14 | 983.81 | 2,034.37 | 17,858.71 |
| 3,000 | 37.17 | 48.79 | 62.35 | 77.98 | 95.74 | 115.74 | 162.80 | 219.82 | 287.38 | 456.34 | 803.27 | 1,661.08 | 14,581.76 |
| 4,000 | 32.19 | 42.25 | 54.00 | 67.53 | 82.92 | 100.24 | 140.99 | 190.37 | 248.87 | 395 38 | 695.65 | 1,438.53 | 12,627.87 |
| 5,000 | 28.79 | 37.79 | 48.30 | 60.40 | 74.16 | 89.66 | 126.10 | 170.27 | 222.60 | 353.63 | 622.21 | 1,286.65 | 11,294.84 |
| 1m5,280 | 28.02 | 36.78 | 47.00 | 58.78 | 72.17 | 87.25 | 122.72 | 165.69 | 216.62 | 344.13 | 605.48 | 1,252 07 | 10,991.07 |
| 6,000 | 26.28 | 34.50 | 44.09 | 55.14 | 67.70 | 81.84 | 115.12 | 155.43 | 203.21 | 322.82 | 567.99 | 1,174.55 | 10,310.51 |
| 7,000 | 24.33 | 31.94 | 40.82 | 51.05 | 62.68 | 75.77 | 106.58 | 143.90 | 188.13 | 298.88 | 525.86 | 1,087.44 | 9,545 75 |
| 8,000 | 22 76 | 29.88 | 38.18 | 47.75 | 58.63 | 70.88 | 99.69 | 134.61 | 175.98 | 279.57 | 491.90 | 1,017.19 | 8,929.35 |
| 9,000 | 21.46 | 28.17 | 36.00 | 45.02 | 55 28 | 66.83 | 93.99 | 126.91 | 165 92 | 263.58 | 463.78 | 959.03 | 8,418.80 |
| 10,000 | 20.36 | 26.72 | 34.53 | 42.71 | 52.44 | 63.40 | 89.17 | 120.40 | 157.40 | 250.06 | 439.97 | 909.81 | 7,986.56 |
| 15,000 | 16.62 | 21 82 | 27.89 | 34.87 | 42.82 | 51.76 | 72.81 | 98.08 | 128.52 | 204.17 | 359.23 | 742.85 | 6,520.94 |
| 20,000 | 14 40 | 18 90 | 24.15 | 30.20 | 37.08 | 44.83 | 63.05 | 85.13 | 111.30 | 176.82 | 311.11 | 643.52 | 5,647.42 |
| 50,000 | 9.10 | 11.95 | 15.27 | 19.10 | 23.45 | 28.35 | 39.88 | 53.84 | 70.39 | 111.83 | 196.76 | 406.87 | 3,571.74 |
| 100,000 | 6.44 | 8.45 | 10.80 | 13.51 | 16.28 | 20.05 | 28.20 | 38.07 | 49.77 | 79.08 | 139.13 | 287.71 | 2,525.57 |

# NEWS OF THE WEEK.

MEXICAN RAILWAY.—Senor Rodriguez, of Soto del Marino, is at Brownsville, Texas. He says he has made a contract to furnish the Telfener Railroad with a large quantity of railroad ties, and work will begin on the main road from Soto del Marino to Tampico and on the branch to Victoria, capital of the State of Tamaulipas, just as soon as the Mexican Government opens the port of Soto del Marino to allow the importation there of rails and other materials.

A dispatch from the City of Mexico, received recently, says Palmer & Sullivan have made arrangements with the government for the completion of the Matamoras and Monterey Railroad.

Material has arrived at Vera Cruz for the Tehuantepec Railway, and 5,000 men are at work on it.

NEW BRIDGE AT LEAVENWORTH, KAN.—A local company has been formed to build another iron bridge across the Missouri at Leavenworth. It is generally understood that the C., B. & Q. R. R. Co. will aid the undertaking.

NEW WATER-WORKS CO.—The East St. Louis and Belleville Water Company of East St. Louis, Ill., has been incorporated. Capital $100,000. Incorporators: Jas. A. Woodworth, N. R. Britton and Julian K. Pogue.

SYRACUSE, PHŒNIX AND ONTARIO RAILROAD.—Capital, $750,000; to connect with the Syracuse, Chenango and New York Railroad at Syracuse, with terminus at Oswego, a distance of 40 miles; incorporated on the 8th at Albany.

BRUNSWICK & ALBANY (GA.) R. R.—Frederick Wolffe and associates having bought this road and reorganized its board of directors, Mr. Wolffe has ordered the construction of the line into Albany and toward Montgomery.

GOOD "STAYING" POWERS.—Trenor W. Park, it seems, died of paralysis of the brain, leaving the Hudson River Tunnel to be yet a monument such as the Ptolemies might have left. "He made three millions," said one of his admirers, "by sticking up for years for a little span of railroad across a hardly inhabited isthmus. Lesseps bought him out." Who will buy out Lesseps?—*N. Y. Tribune.*

MARSHALL & NORTHWESTERN (N. G.) R. R.—This road is to be extended to the Arkansas and Louisianian lines at Magnolia and Lake Charles, giving when completed 400 miles of road.

NEW SEWER PIPE COMPANY.—The Howard Fire Clay Manufacturing Company of Fulton, Mo., was incorporated on the 3d, capital $15,000. The incorporators are Dr. T. A. Howard, J. H. Howard, Edwin Curd, M. F. Bell, Joe C. Rickey and S. T. Thralkeld. The object is to manufacture stoneware, terra-cotta ware, sewer pipe, drain tile and fire brick.

RESIGNATION OF F. B. GOWEN.—The Philadelphia *Press* says: "It has been learned from an entirely authentic source that Franklin B. Gowen will shortly resign the Presidency of the Philadelphia and Reading Railroad Company and the Philadelphia and Reading Coal and Iron Company." Robert H. Sayre, late of the Lehigh Valley R. R., but now President of the South Pennsylvania R. R., is mentioned as the probable future President of the Reading.

THE HARTFORD & HARLEM R. R.—This new project will be vigorously opposed by the New York, Hartford & New Haven R. R. Co., on the ground that it is to be built to sell after the common plan of railway syndicates now-a-days. How far this assertion is correct must be judged from the character and financial means of the promoters of the new road. The old road will undoubtedly be improved by lessening of grades, straightening of curves, and laying new tracks, surveys toward this end have already been made.

UNDERGROUND ROAD AND ARCADE.—Mr. S. A. Cunningham, of 234 Broadway, this city, proposes to tunnel the City Hall Park and Broadway, and form a roadway and an arcade, from the latter of which he proposes to draw his revenues.

THE EAST RIVER BRIDGE.—At the regular monthly meeting of Trustees, held on Monday, it was ordered to advertise for proposals for lighting the bridge with electricity, at once; the New York Wire and Steel Wire Rope Company were given an extension of thirty days upon their contract for traction rope to be used in propelling the cars, and power was granted to petition the legislature for $150,000 to buy land with in Brooklyn.

MISSISSIPPI RIVER IMPROVEMENT.—Gen. Comstock estimates the cost of improving the entire navigation of the river at not less than $60,000,000, this not taking into account levees.

VANDALIA, HILLSBORO & SPRINGFIELD.—J. L. M. Howard is President, and T. R. Higgins, Treasurer. It is the intention to proceed at once to make a survey of the proposed route. Headquarters, Vandalia, Ill.

MISSOURI, WINFIELD & WESTERN R. R.—Incorporated on the 5th, at Topeka, Kan. Capital, $5,000,000. To start on the westline of Missouri and run in a southwesterly direction to Winfield and Cowley County, Kan.

MEMPHIS & VICKSBURG R. R.—Messrs. S. B. Colt & Sons are in Memphis making arrangements for begining work on the above road at a point about nine miles south of that city.

SPRINGFIELD (ILL.) & SOUTHERN R. R.—The survey of this new road is actively progressing and the right of way into Springfield is being secured.

LIMITED.—This word, as applied to the names of business firms or companies, indicates that stockholders are only liable to the amount of their several subscriptions. It has been added to financial nomenclature, and grew up in Wall street, New York City, as did many or similar expressions.

WALL STREET.—This famous New York financial stock center derived its name from the fact that in 1644 a fence was built nearly on its present line or boundary, and in 1653 the city, which was then all south of that line, was enclosed from the East to the North River by a ditch and palisades and breastworks. Hence the name Wall street.

BOWERY.—This well-known thoroughfare, also in New York City, took its name from Stuyvesant's "Bowerie" (Dutch for "farm"), which lay along the road.

NEW LEAVENWORTH BRIDGE.—Mr. Anderson, of Kansas, introduced into the House, on the 8th, a bill authorizing the Leavenworth Bridge Company of the State of Kansas to construct a bridge across the Missouri River at the City of Leavenworth, and lay on or over said bridge railway tracks and ways of wagons, vehicles, foot passengers and animals. The bridge to be a draw bridge with a pivot or other form of draw or with unbroken or continuous spans, the elevation to be not less than 50 ft. above extreme high-water mark and the spans to be 300 ft. in the clear at low-water mark, the main span to be over the main channel of the river at an accessible and navigable point, with spans not less than 160 ft. in length, in the clear on each side of the central or pivot pier of the draw; the next adjoining spans to the draw shall not be less than 250 ft., 10 ft. above high-water mark, meausuring to the lowest part of the superstructure of the bridge, and the

piers of the bridge shall be parallel with the current of the river, the bridge to be at right angles to the current, no bridge to be built, however, until the plan and specifications are approved by the Secretary of War, and any change in such construction, or alteration in the bridge after its construction, shall be subject also to approval by the Secretary of War.

NEW BRIDGE AT ROCHESTER, N. Y.—The new bridge of the Rochester and Ontario Belt Line will be erected 100 ft. south of the lower Genesee Falls. It will be a double-deck pin-connected truss bridge, and will be 800 ft. long, the upper deck being for a single track railway, and the lower deck to be used as a double track highway, with sidewalks on the outsides. There will be six spans resting on three iron towers, which in turn rest on stone piers built on the solid bed of the river and the slope of the river bank. There will be two river spans of 140 ft. each, two of 130 ft. each and one of 110 ft. The foot path will overhang the river on outrigging and will be ornamented with a guard to prevent the possibility of an accident. From the bed of the river to the top of the rail the height will be 130 ft.

THE "STORM KING" BRIDGE OVER THE HUDSON.—The steamboat interest appeared before Congress on the 10th, in opposition to the above bridge enterprise. Mr. Vosburgh the representative of the steamboat men said that the commerce of the Hudson amounts to 19,000,000 tons annually, and that over 90,000 boats pass the disputed points of location every season; the commerce represents $750,000,000, and he claimed that a strong current set across the river where it is proposed to erect the bridge, and this would, of course, be dangerous to boats.

Mr. Beach in supporting the bill for the bridge quoted the bill which provides; "That the bridge shall be built at an elevation over the channel of at least 140 feet above high water mark, and the piers shall be parallel with the current of the river and shall be shaped on the up stream ends so as to break the ice, and shall be placed at a distance from each other of not less than 650 feet.

KANSAS RAILWAY.—C. G. Waite, Chief Engineer of the Kansas Railway Company, is at Fredonia, Kan., making estimates for the bridges and trestling on the line from that point to Asyra, on the K., C., L. and S. K. There will be one trestle of 900 ft., from five to forty-five ft. high.

PIG IRON.—The name pig-iron, given to a certain kind of the metal, originated in this way: When iron is melted it runs off into a channel called a sow, the lateral branches of which are called pigs. Here the iron cools, and is called pig-iron. This is merely a play upon the word sow. Now sow has nothing to do with swine, but is taken from the Saxon "sawan," to scatter; German "sausen," to rush, and ought to be written sous (sows), a word in use still in the expression, "He soused upon him," *i. e.*, swooped or rushed. Having sows or sow for the present channel, it required no great effort of wit to make the lateral grooves the little pigs.

MEXICAN PROJECTS.—The Mexican *Financier* says: From north and south two great transcontinental routes are pushing out, and the months can now be numbered which will yet elapse before the several sections of each system will meet at some central point of the republic. The new International Construction Company has just begun, at Piedras Negras, on the Rio Grande, the work which, in the hands of its energetic managers, will soon open a third line of railway to the boundaries of the United States. The Tehuantepec Railroad, the Vera Cruz and Jalapa Railroad, the Tampico and San Blas branches of the Central Railroad, and the National road branches from Acambaro to the Pacific, with dozens of similar projected enterprises, are intersecting the entire republic from east to west with a network of iron rails over which the countless messengers of commerce and industry will soon bear in all directions the immense benefits of comfort and thrift and national wealth. The Sonora Railroad has already been completed as a link in a new system extending from the Atlantic to the Pacific oceans, and in Yucatan, despite great local difficulties, the railroad is fast uniting all the principal centers of population. And the legitimate consequences are already apparent. Commerce, agriculture, manufactures, mining, industries of all kinds are developing at a pace never before known in this country.

The Minister of Public Works has received a report of the progress of work on the Salina Cruz division of the Tehuantepec Isthmus Railroad up to November 15. The grading of the road has advanced satisfactorily. Little difficulty is experienced in getting labor. An abundance of wood for construction purposes is found in the immediate vicinity of the proposed road. The City of Panama, of the Pacific Mail, brought on the 12th 250 tons of construction material, including 28 platform cars.

Mr. Sebastian Camacho, as representative of the Sinaloa & Durango Railroad, has obtained modifications to the concession given the governor of the state of Durango for building a railroad from the City of Durango to the port of Mazatlan. The concession, as modified, requires the plans for building to be filed with the government within ten months, and 112½ miles of road to be completed every two years. At the end of ninety-nine years the road, with its rolling stock, stations, etc., will revert to the government.

The Government Inspector of the Mexican Central Railroad has reported the line between Leon and Lagos in good condition, and recommends its opening to traffic.

The Governor of Vera Cruz is authorized to build a railroad from Camaron, a town on the Mexico and Vera Cruz road, to Huaiusco, in the same state.

The division of the Mexican National Railroad between Manzanillo and Armeria, on the Pacific Coast, has been opened to freight traffic.

NEW ST. LOUIS BRIDGE.—The amended bill for this structure, as introduced by Senator Vest at Washington on the 8th inst., authorizes the construction of a bridge across the Mississippi River at or near the Chain of Rocks, in the northern part of the city of St. Louis, state of Missouri, and names as the incorporators John L. Ferguson and James Gibson, of St. Louis County; Joseph P. Card, Amos Hoffer, W. Llewellyn Hickman, Jacob Bitner and George S. Case, of the city of St. Louis, and Holland B. Evans, of St. Charles County, all of Missouri. The bridge is to be for railway or general highway traffic and foot passengers; to be a "post route;" the two middle spans to be not less than 400 ft. each; the lowest point of the superstructure to be at least 60 ft. above high-water mark; if a draw-bridge is permitted, the draw or pivot shall be over the main channel of the river, at an accessible, navigable point, and the span shall not be less than 200 ft. in length in the clear, and the piers of said bridge shall be parallel with, and the bridge itself at right angles to the current of the river; and the spans shall not be less than 10 ft. above extreme high water mark. The question of obstruction of navigation to be referred to the Secretary of War.

Section 5 provides that any bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said river as the Secretary of War shall prescribe, and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawings of the bridge and a map of the location, giving for the space of five miles above and one mile below the proposed location the topography of the banks of the river, the shore lines at high and low water, the direction and strength of the currents at all stages, and the soundings, accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject, and until the said plan and location of the bridge are approved by the Secretary of War, the bridge shall not be built, and should any change be made in the plan of said bridge during progress of construction, such change shall be subject to the approval of the Secretary of War.

THE DETRITUS OF HYDRAULIC MINING.—For the Sacramento $250,000 was appropriated. The money is to be used, as the Secretary has discovered, in preserving the channel and the adjoining lands from ruin, which is threatened by the down flow of 38,000,000 cubic yards of detritus each year, caused by hydraulic mining. The Secretary deals with this subject with mild sarcasm and says that while he has allowed the use of some of the money in dredging the channel he has not thought it right to allow the remainder to be used in erecting barriers to restrain the gravel washed down by the miners. He also points to a decision of the Supreme Court of California which held that it was unconstitutional for the State to tax its citizens to pay for work similar to that which the United States is now expected to do there, because the storage of such débris is a private enterprise. In his action he was guided, he says, by remarks made in the debate, "which seemed to receive the unqualified assent of the chairman of the Committee on Commerce that it was not the intention to commit the Government to the policy of providing reservoirs for the storage of detritus from future mining operations."

WEST SHORE ROAD FIRST TRAIN.—The first train put on this road ran from Middletown to West Point on the 8th.

A FLORIDA RAILROAD.—A new railroad company just organized in Florida, to build a road about twenty-four miles long, from Fort Meade to Weohyakapka, has probably the longest name of any in the country, viz.: Fort Meade, Keystone & Walk-in-the-Water.

NARROW-GAUGE RAILWAYS IN NORTHWESTERN PENNSYLVANIA.—A correspondent of the Philadelphia *Press*, writing from Elk City, Pa., says: The oil regions are as much the home or the asylum of narrow-gauge railroads as of money-making and money-losing romances. These roads are particularly adapted to the changing business, on account of their cheapness of construction and operation, and satisfactory working on heavy grades and sharp curves. The grading of an important line, the Pittsburgh, Bradford and Buffalo road has just been completed. It extends from Foxburg, on the Allegheny Valley road, to Kane, on the Philadelphia and Erie, a distance of 90 miles, and is a prominent link in the narrow-gauge chain that will eventually reach from Pittsburgh to Buffalo. At Foxburg connection will be made with the Pittsburgh and Western Railroad, which extends from that point to New Castle, via. Pittsburgh. All that is necessary to the completion of this rough line is the building of a bridge over the Allegheny river at Foxburg, where they cross the Allegheny Valley above grade. The bridge will be nearly 1,000 ft. long and 30 ft. above high water mark, with a wagon and foot-way beneath the track. The work is being pushed day and night by the aid of electric light, and will be done in the spring, when the Pittsburgh, Bradford & Buffalo will pass under the control of the Pittsburgh & Western Railroad.

A portion of the Pittsburgh & Western is the old Parker & Butler road, one of the pioneer narrow-gauges in this country, being built in 1874 and 1875. It was a great financial success, paying the cost of building and half as much more the first year of its existence, the Butler oil field being at that time in the height of prosperity. The Pittsburgh, Bradford & Buffalo was erected out of the Emlenten & Clarion and Foxburg & Clarion roads in 1881. These roads were built in 1876 and 1877 respectively and were marvels of railroad construction, winding over hills at grades of 100 to 250 ft. to the mile, around curves as short as twenty degrees. At Kane connections will also be made with the Bradford & Big Level road, which carries the system to a junction with the Bradford, Bordell & Kinzua Railroad, which was built from Bradford to Kinzua, with a branch to Smethport, in 1879, and paid its stockholders $3,000,000 over cost of construction. This reaches Bradford, connecting with the Bradford, New York & Philadelphia syndicate's narrow-gauges to Warren, Olean and Eldred, by three different lines. At Olean this system forms a junction with the Allegheny Central Narrow-Gauge, which runs through the Allegheny oil field to Rochester.

The Bradford, Bordell and Kinzua this year built another branch from Kew to Eldred, where it connects with the Eldred and Cubaky, which extends to Cuba and Attica, N. Y., on the old Erie road, and by a branch through the Allegheny field to Wellsville on the Erie road. From Attica to Buffalo the system is to be completed by the building of the Tonawanda Valley & Genesee Canal Railway. This will make a complete system of narrow-gauge roads, and their ability to compete with the standard gauges can then be demonstrated either negatively or affirmatively. Whether the narrow gauges can compete with the standard in parallel lines or not is yet to be demonstrated, but as developers of the resources of new sections of country, and for short-lived traffic like that of the oil fields they have proved to be a decided success.

There are still other narrow-gauge lines in the oil regions, such as the Tionesta Valley, which runs from a junction with the Pittsburgh, Bradford & Buffalo Railway, 15 miles south of Kane, to Sheffield, connecting there with the Oil City & Bradford Air Line, which connects with the Garfield & Farnsworth road that traverses the Cherry Grove District. The Wellsville & Pine Creek narrow gauge runs from the Wellsville terminus of the Bradford, Eldred & Cuba to Pine Creek, Pa., 30 miles, and numerous short branches act as feeders to the main system. All of these roads are of uniform gauge, 3 ft. wide, and traverse territory rich in timber, coal, iron ore and limestone, which will furnish freight traffic for 30 years.

THE RIVER AND HARBOR BILL.—A Washington note says that the House Committee on Commerce has decided to proceed with the preparation of a River and Harbor bill.

TWO PENNSYLVANIA RAILROADS CHARTERED.—The Baltimore & Philadelphia Railroad Company was chartered on the 8th. It will run from a point on the boundary line between Delaware and Pennsylvania in upper Chichester township, Delaware County, Pa., to Philadelphia. The directors are Thomas M. King, Allegheny City; John M. Cleve, Pittsburgh; Harry S. Burgessar, Pittsburgh; Robert Garrett, John W. Davis, John J. Cowen, Baltimore, and William S. Bissell, Allegheny City. President, James B. Washington, Allegheny City. Capital stock, $1,200,000.

A charter was also issued for the Newcastle and Salamanca Railway Company, the line of which runs from a point near Wampum, Lawrence County, through Lawrence, Butler, Mercer, Venango, Forest and Warren counties, to a point on

the New York State line at a point near the Allegheny River in Warren County, Pa., a distance of 130 miles. The capital is $1,300,000. The stock is held by James S. Negley, of Pittsburgh; Thomas P. Simpson, W. S. Garner, F. W. Lockwood and Samuel K. Schwenk, of New York; H. E. Collins, John H. McCreary, James S. Negley, Jr., Frank Hunnings, Charles F. Calhoun, William F. Aull and Edwin S. Hanna, of Pittsburgh; A. G. Negley, of Newcastle; L. Scott, of Waynesburg, Ohio.

PROPOSED RAILROAD.—A new line is contemplated to extend from Pittsburgh, Pa., to Wellsburg, on the Ohio River.

RAILROAD SOLD.—The Columbus, Chicago & Indiana Central Railroad was sold by United States Commissioner Fishback, under foreclosure proceedings, at Indianapolis, to a committee representing the Pennsylvania Railroad Company, for $13,500,000.

WICHITA (KAN.) WATER-WORKS.—The engine-house, offices and buildings are fast approaching completion. Eight miles of water-mains are being laid, the piping alone costing $80,000. A brick tower, 180 ft. in height, with electric light attachment, will be erected. It is expected to complete the laying of the water-mains by July, 1883.

IMPORTANT WATER SUITS.—In 1878 Pawtucket, R. I., took its water supply from Abbott's Run, a tributary of the Blackstone, about one mile above the town. The mill owners on the Blackstone below Abbott's Run complained of this diversion, and a dozen or fifteen suits are now pending for the recovery of damages for loss of water power.

THE VALUE OF A HEALTHY MAN, ETC.—The jury in the suit of the estate of Cephas M. Woodruff against H. S. Little, receiver of the Central Railroad of New Jersey, gave a verdict of $25,000 for the plaintiff. Mr. Woodruff was killed last June in the accident at Parker's Creek, near Long Branch.

THE WISCONSIN CENTRAL SYSTEM.—The following are details of the Wisconsin Central system as it exists at the present time: The mileage is 486 miles, of which 65 miles were constructed the present year. It has under construction the Rib Lake Line, which extends from Chelsea to the east, of which some eight or ten miles are under contract. It is proposed to carry this line clear across the State. It has also in view a line into the Penokee iron range. The line has been surveyed and located, and the contract for grading, etc., will probably be let very soon. The present terminal stations are Milwaukee, Portage, Eau Claire and Ashland. From Milwaukee to Stevens' Point and from Portage to Stevens' Point is a farming country, upon which the usual Wisconsin crops are raised. The balance of the line is timber.

HOW RAILROADS PAY FOR SERVICES.—The Pennsylvania Road paid David Dudley Field in one year the sum of $150,000 as fees, and thought its bargain a good one. The Louisville & Nashville pays its official Attorney department about $30,000 per annum, and gets its work done very cheaply at that. Jay Gould has employed ex-Governor Brown, of Tennessee, at an annual salary of $20,000, and thinks his services cheaply engaged at that. Skilled labor in all the departments of the railroad systems of the country, from the head office down to the foreman of the blacksmith shops, are equally indispensable and equally self-estimating in their relative degrees and stations. Skill, perfection if possible, is what is wanted to be attained, and the employment of the possessor of that skill and approximate perfection is as certain as time lasts.

ATLANTIC & PACIFIC CONSTRUCTION NOTES.—The Santa Fe *New Mexican* states that two miles and 500 ft. of track were laid on Tuesday of last week. Twenty-five car loads of steel rails have been received. It is expected that the desired connection at the Colorado will soon be made.

BUILDING IN THIS CITY.—New York spent $3,000,000 less for new buildings last year than in 1881. The high prices of materials and labor and a sluggish market are assigned as the causes.

THE KANSAS CITY, SPRINGFIELD & MEMPHIS RAILROAD.—This road proposes to extend its Rich Hill branch to Bolivar, via Schell City and Humansville, Mr. S. W. Clapp is Chief Engineer.

PENNSYLVANIA IMPROVEMENTS.—The cost of the improvements made by the Pennsylvania Railroad Company on its New York Division, which runs from New York City to Philadelphia, and includes several branches, during the year now soon to close, will exceed $1,000,000. This is without counting the cost of new locomotives and rolling-stock, and the most of it was spent in laying new tracks, making new road-bed, and in building new depots and new bridges. Between Jersey City and Trenton, fifty-one and one-half miles of fourth track have been laid. This is twenty-five and three-quarters miles of track each way. Between Trenton and Philadelphia twenty miles of fourth track were laid, and on the Kensington two and a quarter miles of third track were laid. A stretch of fifteen and one-half miles of fourth track is now being laid between Trenton and Philadelphia, and fourteen miles of fourth track between New Brunswick and Amboy Junction are under contract. Early next year fourth tracks are to be laid from Germantown to the North Pennsylvania Junction, which will give a continuous fourth track from Philadelphia to Torriesdale, a point twenty-seven miles out of Philadelphia. Every car to be obtained is employed in transporting freight, and engines as fast as they can be procured are put in service. An order has been given to a New York company to finish fifty engines as quickly as possible. The Altoona shops are turning out locomotives at the rate of 100 per year, and a large number have been borrowed from the Buffalo and West Shore Company. An order has been placed with a foreign company to build 600 freight cars as quickly as possible.

PROSPECTS OF RAILWAY BUILDING IN 1883.—Contractors are generally confident that the coming season will be one of unusual activity in railroad building. They base their belief on the declarations of railroad officials, on the evident needs of links to connect systems already started, on the low price of labor and material, and on the solid market for railroad securities. Labor promises to be in abundant supply and cheap. The cost of feeding both men and teams will not be much more than half of what it was last spring. The abundant snow in the pineries will insure ties and bridge materials at a reasonable price. Steel rails have never before been offered so low as now. In short, a mile of road can be built at present prices cheaper than at any time since railroad building revived in the West, and never before have Western roads been in such a solidly prosperous condition. The boom of a year ago carried railroad securities higher than they are now, but this boom was founded on expectation and excitement, and not on earnings, as now. Track will be built because it will pay to build it.—*Sioux City (Ia.) Journal.*

A BRIDGE ON BOTTOMLESS MUD.—Superintendent Harahan, of the New Orleans & Mobile division Louisville & Nashville road, tells a *Mobile Register* reporter as follows about the Bay St. Louis bridge: "It is built upon a bottom of tenacious mud or clay. You can drive one pile down upon another for ever so many feet—no one knows how many—and not touch bottom; but we found that when a pile is driven from thirty to forty feet into the mud and allowed to stand a day in that situation, the clayey substance grasps the wood and holds it so tightly that the hammer of the pile driver rebounds when it falls upon the top of the pile. From this idea that the piles have no bottom foundation comes the erroneous report that the bridge rests on nothing, and is only held together by the side-bracing and trussing. The fact is that no bridge or trestle in this country has a firmer foundation, or would so successfully resist for a long series of years the rough usage it receives from the heavy traffic above and buffeting of the waves below.

NEW WHARF COMPANY.—The Wharf Improvement Company, of Galveston, Tex., has been organized, capital $3,000,000. The object of the company is to construct wharves upon the south side of the island, the wharves to be supported on iron piers and carried out to deep water. The company applied to-day at Austin for a charter. The president is Henry Seeligson; vice-president, Sampson Heidenheimer; treasurer, W. H. Sinclair, all residents of Galveston.

THE LAST RAIL.—The last rail on the Southern Pacific and San Antonio railway, connecting with San Francisco, will be laid on the 15th.

ROCHESTER, RENSSELAER & ST. LOUIS.—This company has been organized to build a railroad from Rochester, Ind., to Gilman, Ill., about 100 miles.

SUSQUEHANNA & SOUTHWESTERN.—This company has been reorganized, the Vanderbilt interest now controlling the management. It is stated that work will be begun at once on the line from a junction with the Jersey Shore, Pine Creek & Buffalo into the Clearfield coal region in Pennsylvania.

PITTSBURGH, McKEESPORT & YOUGHIOGHENY.—The Pittsburgh *Telegraph* of Jan. 6 says: "The proposed branch of the Pittsburgh, McKeesport & Youghiogheny leading up the Monongahela from McKeesport, is a fixed fact, and the work of construction will be commenced early in the spring. The line has been surveyed and parties are now engaged securing the right of way. Boarding houses are being constructed and everything will be in perfect readiness by the time the weather will permit work to be commenced. The road is located as far as Cheat River and the intention is to extend it on to the Virginia iron, timber and coal fields, and to finally connect with one of the Southern systems of roads. A capitalist, who is deeply interested in the enterprise, says work will not be commenced at once, as has been stated, but all the preliminaries will be completed during the winter, so there will be nothing to interefere with work when once begun."

A NEW ROAD FROM PITTSBURG TO THE SOUTH.—Within six months work will be commenced upon a new and important railroad, which, it is claimed, will be of incalculable value to Pittsburg's vast iron interests. The line is an entirely new enterprise. The stock is all subscribed, a charter has been secured and the right of way purchased. It will extend from this city directly south, tapping the iron ore beds of West Virginia and Virginia, and will be fully equipped as a first-class road.—*Cincinnati News.*

HARTFORD AND HARLEM R. R.—The engineers who are surveying a route for the Hartford and Harlem railroad are instructed to avoid crossing highways or railroads at grade. It is said that only one road, the New Canaan, must be crossed at grade, and that there will be but one drawbridge on the line, which will be over the Housatonic River. The *Norwalk Hour*, which professes to know all about the project, says that as fast as surveys of ten miles of the route are completed, the railroad commissioners will be called on for their approval and the work of construction begin. A portion of the line will be submitted to the commissioners early in February. "The company," says the *Hour*, "care nothing for subscriptions in Connecticut, but may possibly open the books to the public merely to get its good-will."

HYDE PARK (ILL.) WATER-WORKS TUNNEL.—The Hyde Park water-works tunnel under the lake is progressing at the rate of from ten to fourteen feet per day. The workmen find the work harder as they proceed, which is remarked as being singular and unexpected. The tunnel is to be six thousand feet in length, and its building will consume two years' time. It is to be lighted by electricity as the work progresses.

## APPLIED MATHEMATICS.

FINDING THE TRUE MERIDIAN BY THE NORTH STAR.—The needle reading when the compass is directed along this meridian, is the magnetic declination, or improperly the "variation," and is called "east declination" if the needle points east of north, and "west declination" if the needle points west of north.

Every surveyor should prepare and preserve a meridian, on which the declination should be tested and permanently recorded at least once every three months.

TABLE I.

TIMES AT WHICH ELONGATIONS OF POLARIS WILL OCCUR DURING THE YEAR 1885 IN LATITUDE 40° NORTH.

*Modified from Table in U. S. Coast Survey Report* 1880.

| DATE. | | TIME OF EASTERN ELONGATION. | | TIME OF WESTERN ELONGATION. | |
|---|---|---|---|---|---|
| January 1, | 1885 .. | 12h 35.3m | P. M. | 12h 24 0m | A. M. |
| February 1. | " .. | 10 29.0 | A. M. | 10 22.2 | P. M. |
| March 1, | " .. | 8 38.5 | " | 8 31.8 | " |
| April 1, | " .. | 6 36.4 | " | 6 29.7 | " |
| May 1, | " .. | 4 36.6 | " | 4 31.8 | " |
| June 1, | " .. | 2 37.0 | " | 2 30.3 | " |
| July 1, | " .. | 12 39.5 | " | 12 32.8 | " |
| August 1, | " .. | 10 38.1 | P. M. | 10 27.5 | A. M. |
| September 1, | " .. | 8 36.6 | " | 8 26.0 | " |
| October 1, | " .. | 6 38.9 | " | 6 28.2 | " |
| November 1, | " .. | 4 37.0 | " | 4 26.4 | " |
| December 1, | " .. | 2 38.9 | " | 2 28.2 | " |
| January 1, | 1880 .. | 12 35.0 | " | 12 24.3 | " |

FOR OTHER DAYS OF THE MONTH THAN THE 1ST.

Subtract from the time of elongation corresponding to the 1st of the month that proportional part of the change in time for the whole month, which the interval from the 1st of the month is of the whole month. Elongations occur nearly 3.94m earlier on any day than on the preceding day.

FOR OTHER YEARS THAN 1885.

Take from the table the time corresponding to the month and day, and to the time so found

Add 35m for each year *after* 1885;

Or subtract 35m for each year *before* 1885;

Also add 1m if the year is the 2d after leap year;

Or, add 2m if the year is the 3d after leap year;

Or, add 3m if the year is leap year before March 1.

Or, subtract 1m if the year is leap year after March 1.

FOR OTHER LATITUDES THAN 40° NORTH.

Add 14m for each degree of latitude south of 40° north latitude.

Or, subtract 18m for each degree of latitude north of 40° north latitude.

TABLE II.—OF AZIMUTHS OF POLARIS AT ELONGATION.

This table was computed from the formula

$$\text{Sine of Azimuth} = \frac{\text{sine of Polar distance}}{\text{cosine of Latitude}}$$ or log.

sin. of Azimuth = log. sin. Polar distance *minus* log. cos. Latitude.—*Prof. Landreth's "Instructions."*